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Christmas

YEAR AFTER YEAR we have been interrupting the staid path of technical discussion by hanging up a verbal holly wreath or sprig of mistletoe and calling to you through these pages a message of hearty good-will. We do it again this year—and we make no apology.

Merry Christmas to you, and may the good New Year bring you every happiness—more prosperity, better friends, more joy in the bosom of your family.

The times warrant special rejoicing. We have seen great things done in the last few weeks, things that are truly in the spirit of Him whose birth we celebrate. Peace He sought to bring to us—peace to men of good-will.

In a mighty way we have been striving at Washington to achieve peace—a peace based on the good-will of men. Navies are to be shrunk in size; conference is to replace belligerence in settling Pacific Ocean difficulties.

Happiest of all, from our viewpoint, is that in this mighty endeavor our own America has taken the lead. How the nations are praising us for it. "Peace on earth is here now," says a great London daily. "No nobler contribution has ever been made by any civilized power to any period of the world's history," adds the Lord High Chancellor of England.

Truly a fine preparation for this Christmas of 1921—this Christmas that we of the staff of *Engineering News-Record* hope may be your happiest and your merriest, filled with peace and the ring of children's voices—a happy forerunner, let us hope, of a less troubled, a more satisfying New Year.

More Variety Elimination

THE influence of the paving brick manufacturers in recently making a big cut in the variety of their product to eliminate waste and reduce costs gives promise of extending to other fields. The Associated Pennsylvania Highway Contractors, at their annual meeting last week, passed resolutions favoring a greater degree of standardization in construction plant. A committee of contractors and equipment manufacturers will endeavor to bring about action along this line.

A Form of Bribery

OFFERING a commission to an engineer for goods or materials which enter into construction at his initiative is a form of bribery and an insult against which engineers are constantly protesting. Single protests, however, are likely to be held by those offering these bribes and insults as exhibits of individual whims. Protest from engineering organizations, formally presented, are more effective. Such a protest has recently been addressed to an offender by direction of the Council of the American Institute of Engineers, in the form of an expression of regret that the "well known code of ethics of the profession in matters of this kind is not known to the offender," and with a citation of Clause 2 of the Institute's Code, which declares "unprofessional" the acceptance of "trade commissions, discounts, allowances, or any indirect profit or consideration in connection with any" engagement of a member of the Institute. If every engineer who is improperly approached in the way indicated would bring the matter before some engineering society and the society, on consideration, would officially protest, the engineering profession and business generally would be raised to a higher plane.

Cleveland Union Passenger Terminal

FOR years the question of better railway passenger facilities at Cleveland has been one of controversy, and during the past three years the Public Square station project has been the subject of much criticism. A brief historical review of the subject and a description of the station as now planned appear elsewhere in this issue, in an article largely setting forth the viewpoint of the three railroads going into the project. These plans show clearly that the engineers—with the site for the station fixed—recognize the necessity of segregating and distributing passenger traffic, in so far as possible, to afford the maximum relief from congestion at this point. In carrying out this purpose great ingenuity has been shown, and a distinct advance in the art of passenger station planning has been made. Nevertheless, this journal still believes that a station on the Public Square is wrong and that the location promises to continue as a point of centralized congestion. The question is a public one, concerning not only the local interests of Cleveland but also the interests of the whole public, which will be required to pay the bill ultimately. From this standpoint the project is large enough to warrant more than the usual interest among engineers. As a private business enterprise the building of this

great passenger terminal on the Public Square site may be justified, among other things by resulting benefits of increased realty values and "air-rights" rentals. Otherwise it is hardly conceivable that the managements of the three railroads would so strongly favor the undertaking. The expenditure involved is large; the possibilities of relieving the freight situation are great. But the possibilities are equally as great of serious city congestion. Whether the project is a profitable one or not, viewed as a whole, we believe the latter possibilities to preponderate, that the increased congestion will develop at a point where it needs to be decreased, and that in solving the Cleveland terminal problem for both freight and passenger traffic a better plan could be found by following the principle of decentralization rather than that of centralization.

Construction Is Not Contracting

CONFUSION of construction engineering and contracting is common in discussions of engineering construction. It is frequently remarked of an engineer, who has performed a piece of construction with success, that he would make a good contractor. The prophecy may be true, but it is quite as likely to be false. Construction engineering is essentially the technique of fabrication. It embraces, besides fabrication proper, the selection, maintenance and operation of plant, the purchasing of materials and the management of labor. It does not, generally, embrace the task of seeking work to do, the financing of that work or contractual responsibility for its quality, cost and time of completion, all of which are vital functions of contracting. Demarcation between construction engineering and contracting is represented by an area and not by a line, but it is actual. The distinction should be kept constantly in mind because clear thinking is both good contracting and good engineering.

Supreme Court on "Open Competition"

THOUGH the text is not yet available it appears, from the press reports at hand, that the United States Supreme Court decision in the famous "hardwood case" is very broad and definitely forbids those practices of trade organizations involving exchange of information, sales and prices. Until the full decision is available it is not possible to moralize on the extent or influence of the decision. It sufficeth to say that for the present, then, that the decision will warrant the most careful study. It may not be amiss to express, at the minute, surprise that Justice Brandeis should be found supporting a dissenting opinion. He is commonly expected to be severe in his construction of the legitimacy of business practice.

Uniform Contracts

UNIFORM construction contracts appear more nearly possible than ever before following the conference of engineers and contractors held last week in Washington. One reason for optimism is that now contracting is organized to act with organized engineers and architects and comes forward for the first time with a definite plan. A secondary reason is that uniform contracts are urged by the Department of Commerce and Secretary Hoover is putting his force and the influence of the department into their development. Incidentally the committee membership includes the men who have had most experience in developing the standard contracts of the American Institute of Architects, of the American Railway Engineering Association and of the Bureau of Public Roads. There will, therefore, be none of the floundering about of inexperience in seeking ways to proceed. And back of everything is the stimulus of the growing sentiment that waste and false motion has to be reduced so that industry may revive. Altogether there is good promise that something material and tangible will result from the work of the committee on uniform contracts, and engineers and contractors should gather to its support.

Abolishing the Eight-Hour Crime

AT LAST there is a break in the most serious barrier to honest work that has ever been erected in this country. The crime of 1916—whereby the railroad workers were given 10 hours pay for 8 hours work, with all the consequent overtime evils—has been struck a blow by the Railroad Labor Board. It is true that the relief applies only to a small part of the railroad field and does not affect the brotherhoods favored by the infamous Adamson law. That law, however, was the precedent which was followed in giving the 8-hour rule to the maintenance-of-way forces. Under a decision of the Railroad Labor Board rendered last week, the 8-hour day is not abolished but the provision by which time and one-half had to be paid for overtime in excess of 8 hours is abolished. The normal rate is now to apply up to 10 hours of continuous service, after which the time and one-half rate will be enforced. Time and one-half is also abolished for Sunday and holiday work. The decision is a substantial step forward.

The Four-Power Treaty

WITH the discouraging results of the Versailles peace conference fresh in mind there were many who expected the Disarmament and Far Eastern Conference to end in talk. However, the greatest expectations have been realized. There seems no doubt that heavy naval reductions will result and that a satisfactory procedure with reference to China will be worked out. Already there is an outstanding tangible result—the Four-Power Treaty for disposing by negotiation and conference of the difficulties that may arise regarding the islands of the Pacific. Such is the effect of this agreement that the praise for it has been almost extravagant. It certainly raises new hope to a world discouraged with international conferences and will go far to restore international confidence.

City Engineers in Name Only

INQUIRY would doubtless show that many American cities of considerable size have no city engineer, except possibly in name. That is, there is no well organized engineering department in many of our cities that are large enough to feel their importance. If the office and title of city engineer exists the chances are that the powers and duties of this official are so limited that he is very little more than a surveyor of limited scope, often engaged on a per diem basis, doing little or no designing work for the city and with little or no real authority over construction, his services here being confined to giving lines and grades.

Such a condition seems to have existed at New London, Conn., until recently, where successive administrations appointed a city surveyor, on small pay. Fortunately, the Sewer and Water Board has had an

engineering organization for a long time and has kept records for these two branches of the municipal service. Almost immediately after the new city manager form of government took effect at New London, J. E. Barlow, city manager, decided not to have the work of the city surveyor continued, but instead to have it taken over by the engineering force of the Sewer and Water Board.

Like consolidations, in many cases with considerable enlargement of scope, of engineering activities might well be made in many of our cities. This would result in economy by eliminating duplicate organizations. It really is a most anomalous condition that many of our city engineers today have nothing whatever to do, or if anything very little indeed, with the sewerage or waterworks systems of their cities and oftentimes not with paving either. The time has certainly come for reform in this respect. A realization of this need and action accordingly are more likely to come under the commission-manager form of government than under the old haphazard system of mayor and council with much of the administrative work in the city not really under these officers but carried on by more or less independent boards or still less efficiently by committees of the legislative body.

This is a subject that might well be given immediate and close attention by local engineering societies and individual engineers in the various cities throughout the country. Probably not very much investigation would be needed to show that reforms along the line indicated are quite as necessary in many of our large cities as in the smaller ones. In fact, it would perhaps be easier to name off-hand more large cities without than with efficient, centralized engineering departments.

Supreme Court on Picketing

COMMENT was made in these columns in the issue of Nov. 17 on the reasonable decisions of North Carolina and New York courts regarding picketing during labor disputes. In brief, the courts held that picketing which resulted in annoyance to workers or mental distress was illegal. The same view is held in a U. S. Supreme Court decision handed down Dec. 5, on an appeal of a case involving a strike at the plant of the American Steel Foundries Co., at Granite City, Ill. It settles finally the status of forms of picketing heretofore considered "peaceful," but which place a heavy restraint upon those against whom the picketing is directed.

The court is very explicit. It declares against methods which "inevitably lead to intimidation and obstruction," and further holds that in the case in question "the numbers of the pickets in the groups constituted intimidation." Continuing the argument the court says:

"The name 'picket' indicated a militant purpose, inconsistent with peaceful persuasion. The employees were made to run the gauntlet. When one or more assaults or disturbances ensued, they characterized the whole campaign, which became effective because of its intimidating character, in spite of the admonitions given by the leaders to their followers as to lawful methods to be pursued, however sincere.

"Our conclusion is that picketing thus instituted is unlawful and cannot be peaceable, and may be properly enjoined by the specific term of 'picketing' because its meaning is clearly understood in the sphere of the controversy by those who are parties to it. . . . A restraining order against picketing by that name will advise earnest advocates of labor's cause that the law does not look with favor on an enforced discussion of the merits of the issue between individuals who wish to work and groups of those who do not, under conditions which subject the individuals who wish to work to a severe test of their nerves and physical strength and courage."

The specific limits of peaceful picketing are not set down by the court, it being held that each case must turn on the circumstances and that the measures of restraint are for the "flexible remedial power of the court" to determine. In the Granite City case the stationing of one watcher at each point of ingress or egress of the plant is held legitimate.

All in all the decision commends itself as a reasonable exposition of the general principles upon which the exercise of persuasion in labor disputes should be permissible.

Second Picketing Decision

HARD upon the decision of the United States Supreme Court in the American Steel Foundries case commented upon above comes a second decision of the court, this time involving a case of a restaurant business in Bisbee, Ariz., in appeal from a decision of the Supreme Court of that state.

The decision is an involved one legally for it touches upon property rights in that by the denial of the Arizona court of an injunction preventing the picketing of the restaurant it is held that property is unlawfully taken. In its main aspects, however, the decision follows logically along the lines of the Steel Foundries judgment. As in that case the pickets were guilty of libelous attacks upon the restaurant keepers, their business, their employees and their customers and applied to them abusive epithets. The situation is summed up by the United States Supreme Court as follows: "The patrolling of defendants immediately in front of the restaurant on the main street and within five feet of plaintiff's premises continuously during business hours, with the banners announcing plaintiffs' unfairness; the attendance by the picketers at the entrance to the restaurant and their insistent and loud appeals all day long; the constant circulation by them of the libels and epithets applied to employees, plaintiffs and customers, and the threats of injurious consequences to future customers, all linked together in a campaign were an unlawful annoyance and a hurtful nuisance in respect of the free access to the plaintiffs' place of business."

Four of the nine justices dissented from the majority opinion, entirely on technical grounds, and three of the minority held that it was within the power of the Arizona legislature to declare these means of picketing legal even though they might be violation of the common law. It was because of this feature of the case that the Supreme Court evidently found it necessary to proceed beyond the question of legality of the particular method of picketing and to examine the effects in the light of the Fourteenth Amendment to the federal Constitution which guarantees to every person equal protection of the laws and prevents the taking of property without due process.

Apparently, therefore, the methods that may be followed in bringing pressure to bear on employers in the case of labor disputes have, within a relatively brief space of time, been brought within narrow limits.

Structural Design of U. S. Mail Terminal at Chicago

Steel 150-Ft. Truss in Wall—Girders for Offset Columns—Provisions for Future Changes—Ring Frames at Mail Chutes—Foundation Cantilevers

THE LARGEST STEEL TRUSS used in building construction, 150 ft. in span and 28½ ft. deep, with a weight of 365 tons, is a bold and conspicuous feature of the structural frame of the U. S. Mail Terminal at Chicago. The truss carries six stories over a wall opening for a railway track entrance. This mail terminal is being built by the Chicago Union Station Co. as part of the improvements in connection with the new union passenger station. The building, of steel frame construction, is about 796 x 75½ ft., flanked on both sides by railway tracks and having its ends fronting on Van Buren and Harrison Sts. It will constitute one of a group of notable railway structures in this vicinity. The great truss is shown in Fig. 1 and its location is indicated on the plan Fig. 2. Cantilever concrete foundation girders and steel floor girders supporting offset columns are other special but less unusual features.

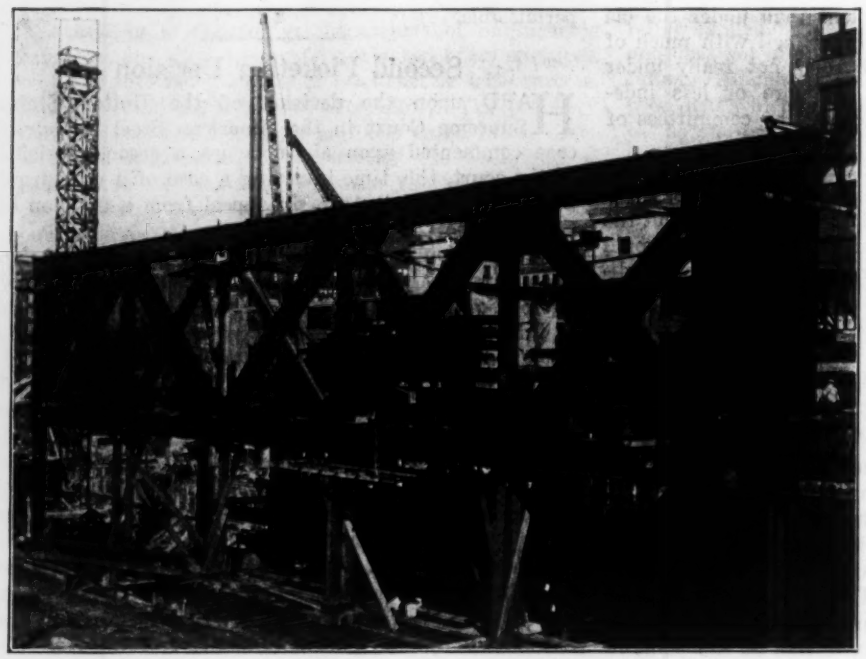


FIG. 1. LARGEST BUILDING TRUSS IN U. S. MAIL TERMINAL, CHICAGO

The building will have a basement over its entire area, a track floor at the level of the track system of the new union station, a first floor at the street level and five upper floors. For railway mail handling the basement and track floor will be operated by the Chicago Union Station Co., the other floors being used by the U. S. Post Office. Along the east side, at the street level, will be a 30-ft. driveway, above two tracks of the station approach. At its south (Harrison St.) end the outer ends of the driveway girders will be framed against columns carrying a parallel driveway along the adjacent freight station of the Chicago & Alton R.R. (see *Engineering News-Record*, Oct. 14, 1920, p. 732). At its north (Van Buren St.) end the driveway will connect with a similar driveway built by that railway.

The great width of wall opening spanned by the truss is necessitated by the track layout (see Fig. 2). Along the west side of the building there will be two parallel loading tracks, one inside and the other outside of the west row of columns. These tracks will be spaced 23 ft. c. to c. and separated by a 13-ft. loading platform, in which the wall columns are located. The inside track will be connected with the outside track by a crossover near the south end of the building, this crossover having No. 7 frogs and a total length of 220 ft. over switch points. Four columns are omitted at the crossover and two are displaced 4 ft. 2 in. from normal position, thus making a span of 149 ft. 4½ in. c. to c. of columns, which is spanned by the heavy truss referred to.

No walls are provided for the track story, except on the east side. Street viaducts protect the north and south ends and the west side is protected by a canopy roof attached to the wall columns and covering the loading platform.

The 150-ft. truss, Fig. 3, is divided into panels of 28 ft. 2½ in. to conform to the column spacing above it. As the columns which carry the truss do not extend above its top chord and are offset 50 in. from the upper wall columns supported by the truss, a heavy end construction is required for shear stresses. Thus a truss post is placed 50 in. from the supporting column and heavy web plates are riveted over the flanges of the column and post for the entire depth of the truss. A total load of about 4,050 tons will be carried to the upper chord of the truss.

In depth the truss will be 28 ft. 8 in. over the chord cover plates, while the height between floors is 21 ft. The bottom chord is considerably below the first floor level, giving a clear headroom of 17 ft. above the rails at the track entrance. To it are attached brackets for a concrete canopy over the loading platform. The upper chord is above the second floor level, coming just below the window openings. Beams and girders of the first floor are framed against the truss posts, while those of the second floor are carried by hangers attached to the web of the top chord. A trough section about 36 x 36-in., giving a gross sectional area of 304 sq.in., is used for the chords, which are of identical design but reversed in position. The posts are of I-section and the diagonals of I- or double-channel section. Distributing girders for the upper columns are seated on the top chord as shown in Fig. 4, their webs registering with those of the truss chord.

Drilled holes 1⅛-in. in diameter were reamed to 1¼-in. for 1-in. rivets, and the specifications provided that the

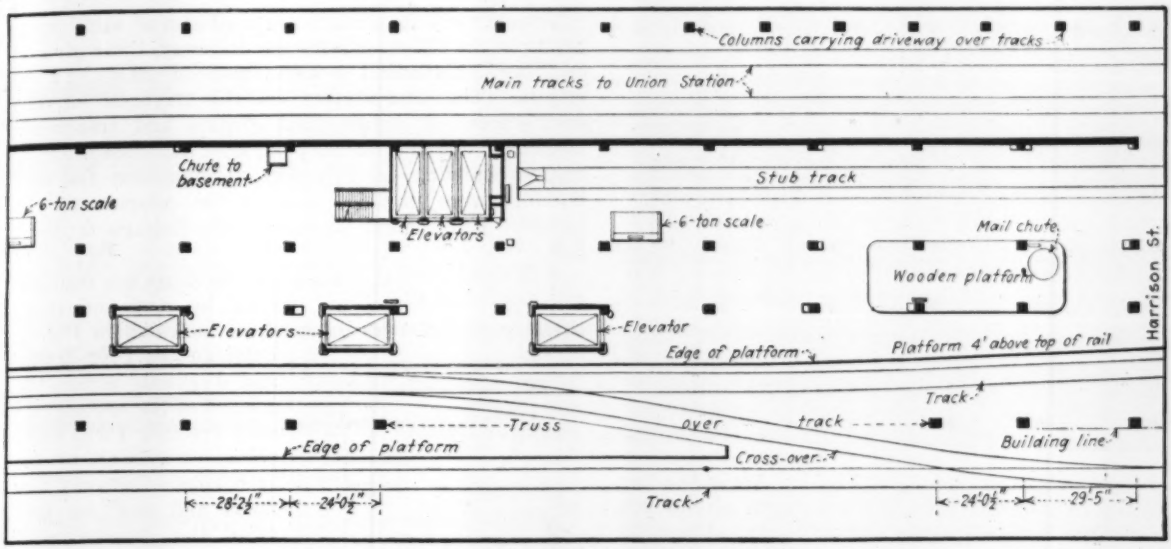


FIG. 2. PART PLAN OF TRACK FLOOR OF MAIL TERMINAL

truss should be assembled and reamed at the shops. The weight of the completed truss is 365 tons, 11 tons of which are field rivets. As erected, the truss has a camber of 2⅞ in. All members will be encased and covered by concrete protection and the bottom chord will be further protected by a blast plate over the track.

Foundation Piers and Cantilevers

Concrete foundation piers 4 to 6 ft. in diameter are sunk through the Chicago clay to hardpan at an average depth of 50 ft. below datum. The bottoms of the piers are belled out in the usual way in order to increase the bearing area and thus limit the load on the hardpan to about 6 tons per square foot.

Foundation conditions were complicated by the presence of a freight tunnel, about 7 x 6½ ft., in the clay at a depth of about 45 ft. and passing close to the location of a line of piers, as shown in Fig. 5. The site of the new building includes an old freight terminal which was connected by elevators with an underground freight yard of the Illinois Tunnel Co. and although the numerous branch tunnels and connections at the yard have been abandoned, the main line is still in service.

Alternative methods of overcoming this difficulty were to rebuild the tunnel on a new location or to relocate seventeen piers so as to avoid the tunnel. The latter course was adopted as being the more economical. This displacement of the pier centers from the column centers varies from 2 to 5 ft. The columns are carried on concrete cantilever girders or on girders supported by two piers. These girders are placed below the basement floor, except that at one of the driveway columns there is a cantilever girder a few feet below the track floor, since the basement does not extend under the driveway.

Column shoes or bases are seated usually on I-beam grillage on the heads of the piers. For the two heavy columns which carry the long truss, a more elaborate system is used. Each of these columns has a rolled steel slab base, supported by a pair of 4-ft. distributing girders 8 ft. 3 in. long, these girders in turn resting on a row of five 24-in. plate girders and four 24-in. I-beams 8½ ft. long. This lower course is seated on the top of a concrete pier 9 ft. 2 in. in diameter.

In the typical structural arrangement below the first floor there are five longitudinal rows of columns forming two outer bays about 31 ft. wide and two inner bays

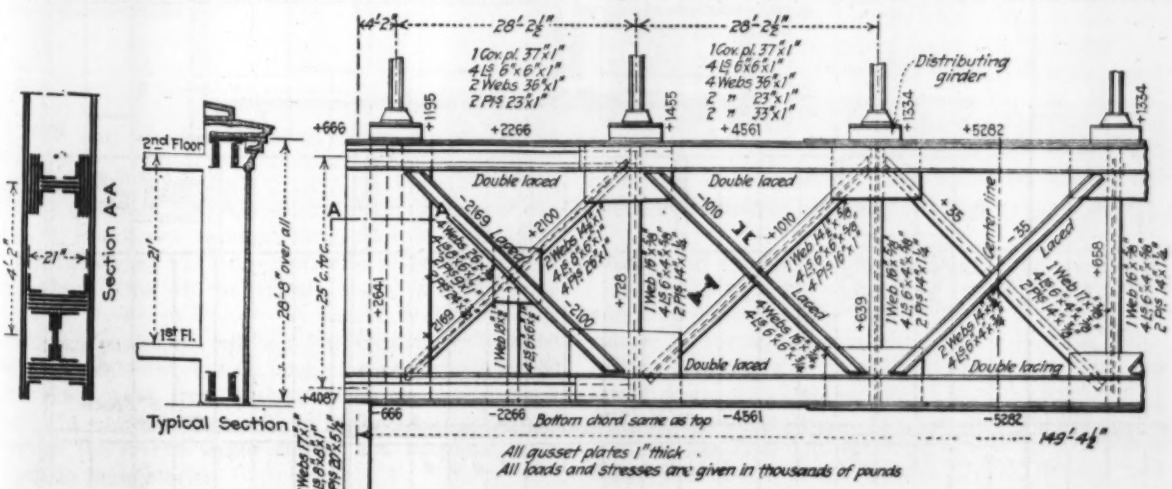


FIG. 3. DETAILS OF 150-FT. TRUSS CARRYING SIX STORIES

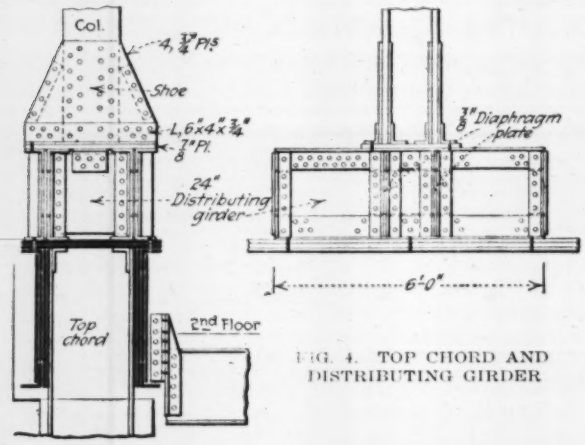


FIG. 4. TOP CHORD AND DISTRIBUTING GIRDER

of 16 and 26½ ft., as shown in Fig. 2. Above the first floor, one of the outer rows is omitted as it carries only the girders for the longitudinal driveway. From the part plan of the first floor framing, Fig. 6, it will be seen that longitudinal beams between the columns carry transverse I-beams of 7- to 9-ft. spacing. This type of construction was adopted as being more flexible in providing for possible alterations due to mail handling equipment than any long-span concrete floor construction, although the cost of the adopted type was about 10 per cent greater.

An offset in the column spacing occurs, however, at the first floor, where the middle row of columns is offset 4 ft. from the columns below. For this reason the columns of the 16-ft. bay carry pairs of transverse girders in the first floor framing, upon which are seated the columns of the second and upper floors. This unsymmetrical arrangement of columns, due to the trucking space required at the track floor, is shown in Figs. 6 and 7.

Transverse plate girders are used also at some panel points in the 31½-ft. bay for the driveway, these girders carrying longitudinal I-beam joists of 29 ft. 2½ in. length. The introduction of this reversal of the arrangement of longitudinal girders and transverse I-beams is due to a former plan, later abandoned, for an express building on this site. Connections for this building were provided also on the columns of the adjacent new freight station of the Chicago & Alton R.R.

Numerous circular openings in the floors are required for mail chutes and are formed by rings of 10-in. channels with flanges outward, as indicated in Fig. 6. Lugs on the floor beams and diagonals across the corners of the rectangular floor framing form eight points of attachment for each ring. Concrete slab floors and roof are provided, the concrete encasing all steel work.

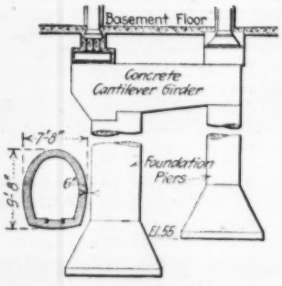


FIG. 5. CANTILEVER GIRDERS CARRY WALL COLUMNS ABOVE TUNNEL

Creosoted wood block paving on concrete floor slabs will be used mainly for floors and driveways, with 2-in. blocks for the former and 4-in. for the latter. These blocks will be laid on an asphalt paint coat and with asphalt filler. Cement flooring will be used in toilet and machinery rooms. For the track spaces, the concrete slab will be left with a rough surface as a base for the finished concrete floor, which will have recesses for short wood blocks carrying the rails. The exterior walls will be of gray brick with terra cotta trimmings and steel sash. Steel rolling shutters are provided for the openings along the driveway at the backing-in space for wagons, which is inside of the building line, on a

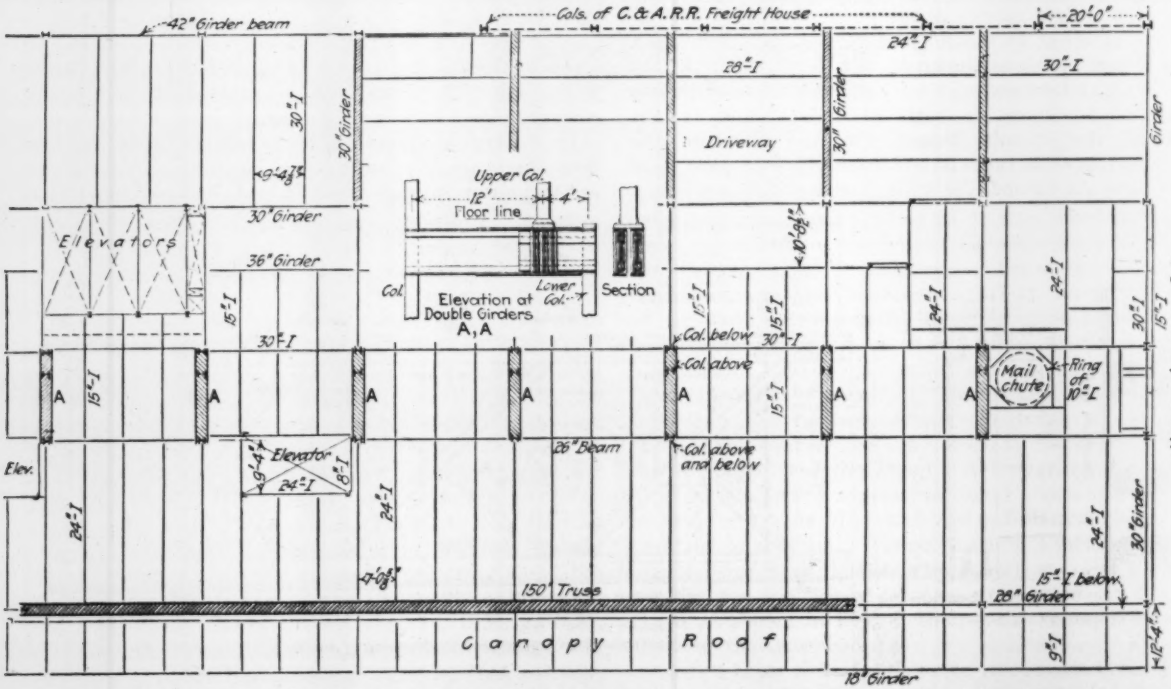


FIG. 6. PART PLAN OF FIRST FLOOR FRAMING OF CHICAGO MAIL TERMINAL BUILDING

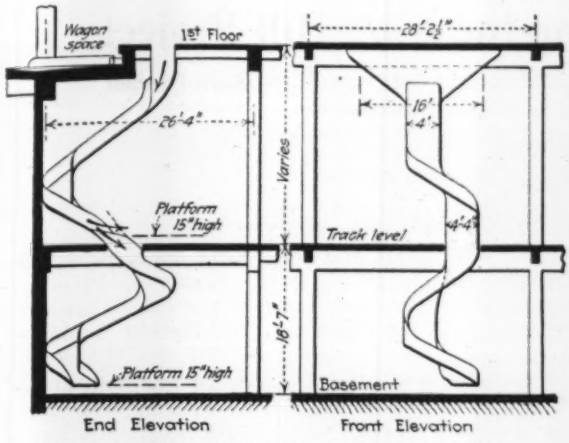


FIG. 7. SPIRAL CHUTES FOR HANDLING MAIL

level with the driveway and 2 ft. 6 in. below the first floor. Floors are designed for live loads of 150 and 200 lb. per square foot, with 250 lb. for the driveway outside of the building and for the backing-in space for wagons.

Mail Handling Equipment

Details of the extensive mechanical equipment for handling and conveying mail matter have not been developed fully by the Post Office authorities. In addition to fifteen large freight elevators there will be a number of spiral and inclined chutes for the rapid lowering of sacks and packages from floor to floor, these chutes delivering to tables, platforms or horizontal belt conveyors. One of the spiral chutes, serving three floors, is shown in Fig. 7. A special feature of this mechanical equipment will be a 5-ft. escalator or inclined traveling platform, 144 ft. long, to carry trucks loaded with mail sacks from the basement up to the track floor. In addition there will be inclined belt conveyors between the several upper stories and horizontal conveyors in these stories.

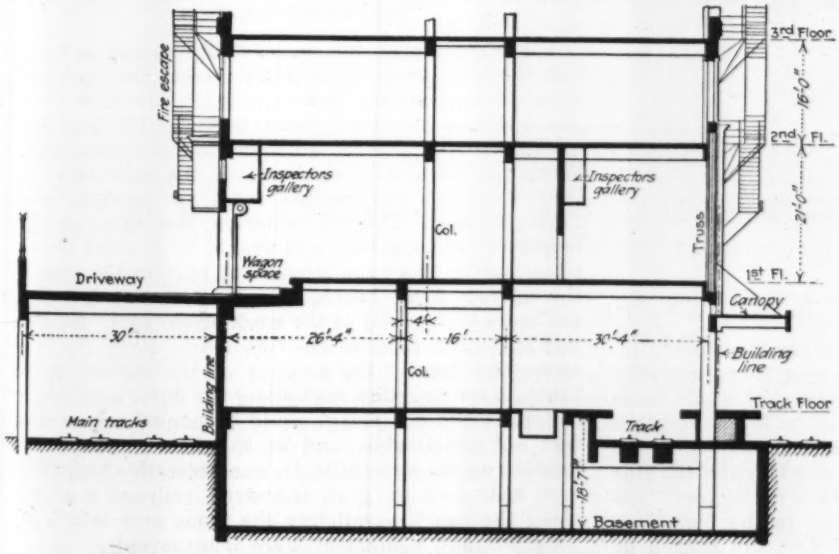


FIG. 8. CROSS-SECTION SHOWS TRUSS AND OFFSET COLUMNS

The general and structural designs for this mail terminal building were prepared by Graham, Anderson, Probst & White, architects. Both design and construction are under the direction of J. D'Esposito, chief engineer, and A. J. Hammond, assistant chief engineer, of the Chicago Union Station Co. The R. C. Wieboldt Co. has the general contract. The steelwork, including the 150-ft. truss, was fabricated by the McClintic Marshall Co. and was erected by the Kelly-Atkinson Construction Co.

Lowell Goes Back to Mayor-and-Council Plan

At a popular election held in October the electorate of Lowell, Mass., decided by a vote of 8,534 to 7,903 to change from the commission plan of city government to the mayor-and-council plan. Nearly all the administrative officers of the city will be appointed by the mayor, subject to confirmation by the council. Both the mayor and members of the council will be elected for terms of two years. The mayor will be paid $5,000 a year and councilmen only $300. The council will consist of fifteen members, one each elected by the nine wards of the city and six elected at large. The mayor will appoint the city solicitor without confirmation by the council, and the council will choose a city clerk, treasurer, and auditor independently of the mayor. All the other administrative officers will be appointed by the mayor and confirmed by the council. A board of public service of three members will appoint a city engineer, superintendent of streets, and superintendent of waterworks. There will be a board of health, a park commission, a budget and auditing commission, besides several other boards. Among the individual administrative officers appointed by the mayor and confirmed by the council will be a purchasing agent, a city physician, a superintendent of wires, a city bacteriologist, an inspector of public buildings, and an inspector of milk and vinegar—the latter not until a vacancy occurs since this office as well as those of sealer of weights and measures and of moth superintendent are under civil service rule. The entire city government will be swept out of office when the new charter goes into effect on Jan. 1, 1922. Between now and then a new mayor and council will be elected and the various administrative officers appointed as already outlined.

Volume of Cargo Passing Through Panama Canal

According to a report recently issued by the transportation division of the Department of Commerce, the volume of tonnage passing through the Panama Canal for the first nine months of 1921 was greater than the total tonnage for any other twelve months except during the calendar year 1920. For the nine months ended Sept. 30, the total tonnage handled was 7,912,737 long tons. This figure compares with 11,236,119 long tons for 1920 and 7,468,167 long tons for 1919, that being the highest year except 1920.

Concrete and Gunite Flumes on the King Hill Project—II

Five Types Compared as to Cost, Maintenance, Construction and Serviceability—Semi-Precast and Monolithic Flumes Have Slight Advantage

By Walter Ward
Project Manager, King Hill Project, U. S. Reclamation Service, King Hill, Idaho

This concluding article describes two combination types of flumes, the combination concrete-and-gunite and the semi-precast concrete. The bell-and-spigot type, no-joint and gunite flumes were described in the issue of Dec. 8, 1921, p. 926.—Editor.

Combination Concrete-and-Gunite Flume

THE combination concrete-and-gunite flume has a floor with a uniform thickness of 5 in. while the side walls vary in thickness from 2½ in. at the top to 4 in. at the bottom. The inside dimensions of this flume are 8 ft. 7 in. by 5 ft. and it has a capacity of 268 sec.-ft. with a freeboard of 1 ft. The concrete was a 1:2½:5 mix. The gunite was mixed in the proportion of 1 part cement to 5 parts sand but as 20 per cent of the sand was lost in the rebound, the gunite in

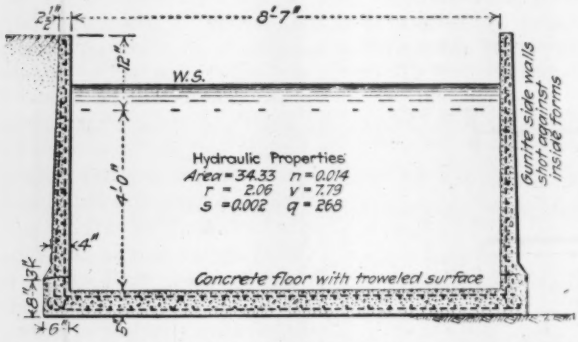


FIG. 8. DETAILS OF CONCRETE-AND-GUNITE FLUME

place is in the proportion of 1 to 4, there being very little cement lost in the rebound.

A double row of longitudinal or temperature reinforcing steel was placed in the floor to permit of a wider spacing of the bars; otherwise they would be so close together it would be difficult properly to place and tamp the concrete. The transverse bars in the floor bend at right angles and extend through the side walls which are reinforced as vertical cantilevers. Additional reinforcing steel was used in the bank wall to make it safe against external pressure caused by blow-sand accumulating behind the flume. The higher compressive strength of gunite over ordinary concrete permits of the reduction in section of the side walls at the base from 5 to 4 in. This reduced thickness of side wall has the advantage of reducing the amount of longitudinal or temperature steel required as the amount of this steel is based on a per cent of the total area of gunite.

This flume is designed with sufficient temperature steel to force it to crack at 6-ft. intervals. In arriving at the percentage of temperature steel required, it was assumed that as this flume would be built in the late fall it would be subjected to a range of temperature of 70 deg., from which it was computed that ½ to 1 per cent would be required when ¼-in. bars were used with an elastic limit of 55,000 lb. per sq. in. It was observed after this flume had been built for some time that fine hair cracks appeared at more frequent intervals than 6 ft., usually at 18 in. intervals and at the point where the gunite area was reduced and weakened by the vertical transverse bars.

The lower 3 in. of the side walls was built of concrete and poured in conjunction with the floor, forming a curbing against which the forms for the gunite side walls could be placed and held in exact line and grade. By using a concrete floor, with a steel troweled surface in place of a rough gunite, the value of n in Kutters' coefficient was reduced from 0.018 to 0.014 for the floor. This reduction permits the building of a flume 8 ft. 7 in. wide which will have the same carrying capacity as one 9 ft. 6 in. wide where the floor is untroweled gunite.

A 4-in. tile drainage system was provided similar to the one described in connection with the bell-and-spigot flume.

Compressor Location

The compressors, instead of being spaced at intervals along the flume bench and moved as the work progressed, were set up permanently on the bluff above the flume at a central point and the air was conducted through pipe lines leading to the cement guns. When the guns were operating at the maximum distance from the compressors these air conduits were 2,200 ft. long. The transmission loss through this length of pipe was high and should be avoided if possible, but in this case it was not practicable, due to the narrow flume bench, to set up the compressors and move them along as the work progressed. Neither was it feasible to move the compressor along the bluff above the flume. On account of the narrow flume bench, a construction road along the flume over which materials and equipment could be hauled with teams was not practicable, and as the bench, due to its location on the steep hillside, was accessible only from each end, a 36-in. gage industrial railroad was laid along the bench paralleling the flume over which all materials and equipment were transported.

The railroad extended to a central mixing plant which was located at the upper end of the work where a pit with an unlimited amount of sand and gravel was uncovered with a small amount of stripping. At the mixing plant two mixers were installed, one to mix concrete and the second to mix dry sand and cement ready for use in the cement guns.

The forms needed for the walls as may be noted in Fig. 9 were inside panels built of shiplap with a system of cross-bracing to hold them in alignment. As only one side of the walls was formed and no pressure exerted by the gunite, these forms were comparatively simple and were easily and rapidly set up and removed. A top templet only was needed to force these panels to conform to the alignment, the bottom being held tight against the concrete curbing by

FIG. 9. FORMS FOR CONCRETE-AND-GUNITE FLUME PLACED AFTER FLOOR DEPOSITED

means of spreaders between the panels. After the forms were placed and securely braced a 1-in. board, which was straight for the tangent and cut to the proper radius for the curves, was at first nailed along the top to act as a form for the top of the wall, but this was later omitted as it was found that pockets of rebound would collect against this board and, when the forms were removed, would brush off and leave a bad looking top. Instead of shooting the gunite against this top board it was shot directly against the vertical wall and struck off level with a steel trowel which left the top of the wall sound and smooth.

Method of Construction

Following the preparation of the subgrade and the installation of the drainage system, the reinforcing steel, which had previously been cut and bent in a central yard, was placed. Fig. 10 shows the reinforcing steel assembled and suspended from a framework used to hold it to line and grade, and the curbing forms set ready to receive the concrete. The concrete from the central plant was hauled over the track to its location in the flume in 1-cu.yd. side-dump cars and discharged from the cars onto the floor by gravity. The bottom of the inside curb forms served as a gage for the top of the floor.

After the concrete floor had been allowed to set sufficiently to permit workmen to walk on it without injuring its surface, the framework shown in Fig. 10 was moved ahead and the gunite forms shown in Fig. 9 were erected. The gunite aggregate mixed dry in a concrete mixer at the central plant was sacked in batch quantities and hauled on flat cars to the cement guns. The guns were mounted on a flat car and were moved along the industrial track, at all times keeping them within 50 ft. of the work. The guns were kept together, a nozzleman working on each side of the flume and one crew feeding both machines; thus the entire operation was under the supervision of one foreman and fewer laborers were required.

In building the side walls, application of the gunite began at the bottom and was carried upward. This allowed the rebound to escape with less danger of any of it being buried in the wall. Gunite, having a tendency to build up upon whatever it strikes, could not be shot at right angles against the wall until the space between the steel and the forms had first been filled by shooting at an angle. Square bars proved decidedly objectionable in this connection as it is almost impossible to completely fill in the space between the bars and the forms and insure that the bars are entirely imbedded. Round bars of small diameter should be used when gunite is applied from only one side. If too much water was mixed with the gunite or too great a thickness applied at one time on a vertical wall, the gunite had a tendency to sag and slough off, leaving cracks along the horizontal bars. Experience demonstrated that the walls should be built in layers of about 1½ to 2 in. with a moderate moisture content and each coat allowed to set some-

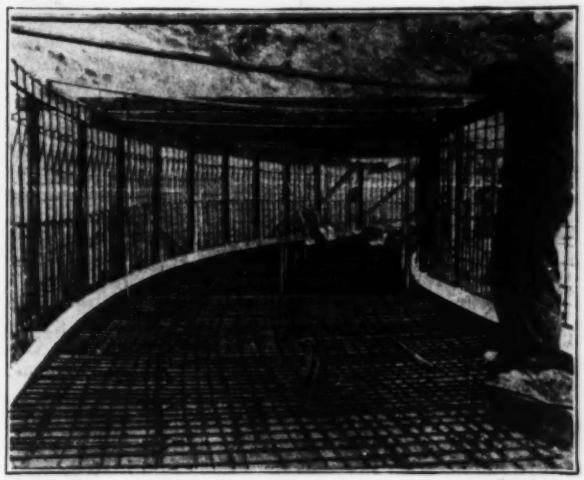


FIG. 10. FRAMEWORK TO SUPPORT STEEL FOR CONCRETE-AND-GUNITE FLUME

what before the next is applied. To insure a proper thickness of wall a gage marking the finish lines of the wall was hung from the top of the forms and was kept close up to the nozzleman as the finish coat was applied.

As most of this flume was built during the winter months it was necesary to heat the steel and forms ahead of the nozzleman and protect the green gunite from the frost. The former was accomplished by attaching the water hose to a steam line and playing live steam on the steel and forms, and the latter by covering the entire flume with a burlap or other covering and keeping stoves in the flume for from two to five days. During extreme cold weather sacks filled with hay were piled against the outside walls of the flume. Gunite will set up sufficiently to resist frost action in about half the time required by concrete.

Tests of Sand for Gunite

A well-graded concrete sand obtained at the central mixing plant was first used in this gunite work. The rebound was unusually high, amounting to at least 30 per cent of the total aggregate and consisting mostly of the coarser particles. With this in mind experiments were conducted to determine which of the sands available would be most economical and what effect would be produced by the addition of hydrated

lime to the sand and cement mix. Although these experiments were not by any means exhaustive, they did bring out some interesting and valuable information, as follows:

1. The rebound can be decreased by the addition of hydrated lime and the decrease is proportional to the amount

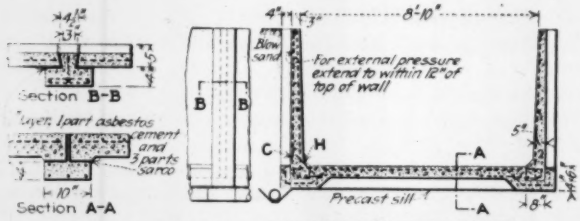


FIG. 11. DETAILS OF SEMI-PRECAST FLUME

of lime used, up to a proportion of 1 part of lime by weight to 10 parts of cement.

2. The rebound decreases in proportion to the decrease in sand particles rejected on a ¼-in. screen. Especially is this true where the reinforcing steel is closely spaced and of large diameter.

3. These experiments showed, with the grades of sand used, that the smaller the sand particles the less the rebound. As an example, using a sand 100 per cent of which passed a ¼-in. screen, 92 per cent a No. 10, 90 per cent a No. 20, 80 per cent a No. 30, 68 per cent a No. 40 and 50 per cent a No. 50, the rebound was 20 per cent as compared to 30 per cent rebound for sand of which 100 per cent passed a ¼-in. screen, 95 per cent a ¼-in. screen; 82 per cent a No. 10; 75 per cent a No. 20; 56 per cent a No. 30; 30 per cent a No. 40; and 19 per cent a No. 50 screen.

4. The density of the gunite in which the fine sand was used was 8 to 10 per cent greater than the gunite made of the coarser sand.

A total of 3,300 lin. ft. of this combination type of flume was built. It has all the advantages of the all-gunite flume, with the disadvantages eliminated.

The flume was built on a foundation that was extremely treacherous but after being in operation one year, at the time of writing, no settlement or disturbance of the foundation has occurred, and as the flume is watertight, no settlement or erosion of the foundation is expected. This flume has fulfilled all expectations and is a type well adapted to an insecure foundation. No maintenance or repair work has been done on it nor is any now needed. It should last its expected useful life with a very low maintenance charge.

Semi-Precast Concrete Flume

The construction program for the fall of 1919 and spring of 1920 contemplated the building of more than two miles of concrete flume. The construction season was limited to the non-irrigation season, and to accomplish this amount of work in the allowable time, it was either necessary to purchase additional equipment and increase the organization sufficiently to push the work through in the short construction season, or to provide some means of doing a portion of the work during the summer months. Considerable doubt existed as to whether or not it would be possible to secure the required number of men to hurry the work. At that time there was an extreme shortage of labor, and further, it was not considered economical to purchase the required amount of additional equipment since it would not be needed for subsequent work. Therefore, the idea of doing all of the work during the non-irrigation season was abandoned. Included in the contemplated work was a stretch of 4,500 lin. ft. where the foundation was mainly lava rock and advantage could be taken of this conditions to design a flume from which a small amount of leakage would not be serious.

To meet all of the above conditions a semi-precast concrete flume was designed and built. The side walls of the flume were cast during the summer months, were set up during the winter months and the floor and joints were poured in the spring, completing the flume.

Except on the inside curves the precast side walls were built in 12 ft. 2-in. lengths, 3 in. wide on top, and 5 in. wide at the base. A short section of the floor was poured in conjunction with the side walls giving the slab an L-shape with one leg 5 ft. 6 in. long and the short leg 8 in. in length. The wall

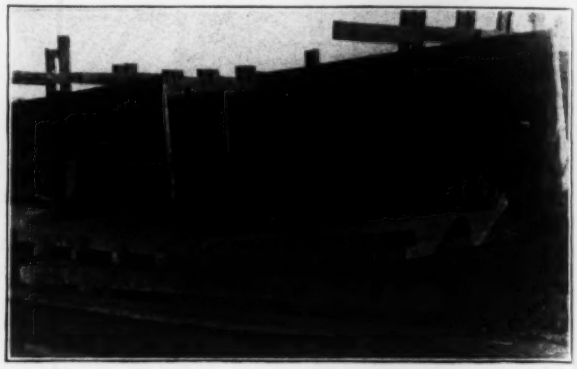


FIG. 12. CURVED SLABS OF SEMI-PRECAST FLUME

slabs were designed to act as vertical cantilevers when placed in the flume section. The lower 6 in. of the slab, properly a part of the floor, was imbedded in concrete when the floor was poured. The transverse bars from the wall slab extended through the short leg of the slab and 21 in. into the concrete floor poured in place, lapping the floor transverse bars 15 in. Some question arose as to whether there would be sufficient bond developed between the old and new concrete to resist shear and to overcome any weakness from this source, the corner bars marked C in the drawing (Fig. 11) were added. The hook bars in the fillet, marked H, were also added as an additional factor of safety against overturning. The concrete floor which was poured in place extends under and 6 in. up the outside of the wall. This is to prevent any possible leakage following around the joint between the old and new concrete, and also to furnish a solid footing for the side walls. Additional steel was placed in the slabs on the bank side wherever it was anticipated that there would be any external pressure caused by the accumulation of blow-sand. A nominal amount only of temperature or longitudinal steel was required as each 12-ft. section was free to move at either end. Concrete sills 4 in. thick and 10 in. wide with a 6-in. vertical leg at each end were placed across the subgrade at the required intervals to support the wall slabs. These sills were built to exact line and grade and the inside of the vertical legs marked the exact position of slabs while the top of the sill established the grade.

The joints between the precast slabs were closed with a pilaster poured in place connecting with the

sills and filling the wedge-shaped space between two adjacent slabs. These pilasters with the sills formed a collar around the flume at the joint and provided a slip joint for the wall slabs.

Expansion and contraction joints were provided by painting each end of the precast slabs and both ends of alternate floor sections with a 1:3 mixture of asbestos cement and asphalt. This same mixture was used to paint the top of the sill and outside of the walls, between the wall and pilaster, to form the slip joint.

As most of this flume was built on a lava rock foundation the only drainage necessary was an occasional cross-drain built to take care of storm water. However, at the short stretches built on a clay foundation, a 4-in. open joint tile drain was placed with relief drains every 100 ft.

Formwork Made Simple

As is the case with all concrete work where the structure consists entirely of thin walls, the formwork is one of the principal items of cost and it is therefore necessary that the forms be as simple as possible and admit of easy and rapid erection. For the present slabs the forms consisted of flat panels made up of shiplap nailed to 2 x 4-in. studding similar to the panels used in the other types of flume construction. These panels were laid flat on a frame consisting of three longitudinal timbers rigidly cross braced, forming a stiff supporting and tilting frame. A board cut to the dimensions of the cross-section of the slab was nailed across each end of the panel to form the ends. In building straight slabs the form panels were wired down to the horizontal frame but for curved sections the panels were lashed to curved templets which were bolted to the framework. Fig. 12 shows one of these curved forms in place filled with concrete. The slabs were 12 ft. 2 in. long on tangents and the outside of the curves. The slabs on the inside of the curve were reduced in length the necessary amount to keep the joints on radial lines. These shorter slabs were molded in the same forms by simply inserting the end pieces in the form at the proper location.

Extraordinary care was taken in the field location of this flume and numerous points were referenced in order that the location might be accurately re-established at any point. After the location had been completed and checked, the entire length of the flume was divided into 12-ft. 2-in. sections and each slab assigned a number. With this information a chart was prepared showing the exact dimensions and shape of each slab and its location in the completed flume. A map was then made of the casting yard showing the number of each slab and its location. The yard layout was such that the slabs could be most readily loaded and hauled to the point of erection in the flume with a minimum amount of moving of the loading equipment.

After the slab forms had been set in position the reinforcing steel was placed in them in the form of a mat. The 1:2½:5 concrete, mixed at a central plant, was hauled from the mixer to the casting yard in ¾-yd. hoppers mounted on wagons. The concrete was discharged from these hoppers into the forms by gravity where it was tamped and spaded into place. The exposed surface of the concrete which was the inside face of the flume wall was rodded off to exact thickness and section by a straight edge guided on the ends of the panel forms. In the case of the curve sections the straight edge or screed board was cut to the required curvature.

As these slabs must be allowed to set for two days in summer weather before it is safe to up-end them and recover the forms, an average day's run with a total of 60 forms was 20 slabs. However, when forms were available it was easily possible to fill 40 in 8 hours. There were 706 slabs manufactured. The slabs were up-ended (see Fig. 13) by a home-made portable derrick and held in a vertical position by a simple system of framework.

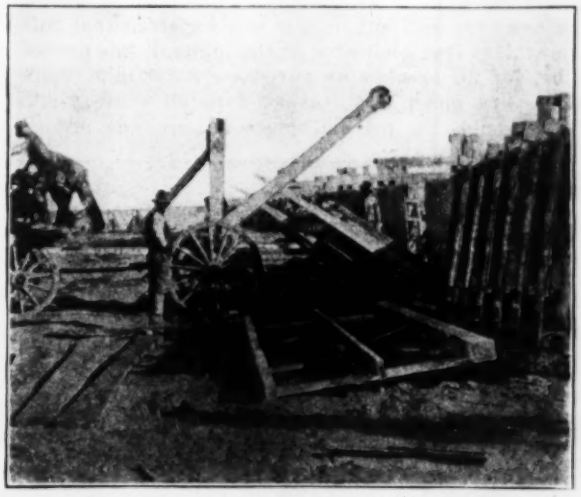


FIG. 13. HOMEMADE PORTABLE DERRICK FOR UP-ENDING SLABS

After the flume bench was graded a 36-in. gage industrial track was laid parallel to and 8 ft. from the center line of the flume. This railroad was used to transport the slabs and all other materials and equipment used in the building of the flume. A tramway laid up the face of the bluff was used to connect the railway with the casting yard, which was located on the top of the bluff 1,000 ft. from the nearest end, and 200 ft. above the flume bench. Using the portable derrick shown in Fig. 13 the slabs were loaded two on a car and lowered down the incline by the use of a steam hoist. At the foot of the incline the slab cars were coupled to a 3-ton locomotive and run out on the track opposite their position in the flume where they were unloaded and set in position by a stiff-leg derrick. The mast and one leg of the derrick were mounted on two flat cars placed on the track with the second leg resting on a dolly which rolled on a portable track made up of short-length 6 x 12-in. timbers. It was necessary to start setting these slabs at the end nearest the slab yard and work away from the yard in order to operate the derrick on the track and not have it in the way of the incoming slabs. When the slabs had been set in their exact position on the fills they were held in place by a cleat joining them to a slab previously placed and by an occasional cross frame as is shown in Fig. 14.

When the slabs had been set in position the concrete floor was poured in sections of the same length as the slabs and as it was necessary to place an elastic filler

between two adjacent sections, the floor was poured in alternate sections.

Concrete for the floor was mixed at the central mixing plant located at the junction of the railroad and the tramway. For the purpose of conveying concrete to the flume and spouting it over the side of the wall, two specially constructed hopper cars were used. The hoppers on these cars could be raised and lowered in 6 x 6-in. timber guides by means of a hand crab. The hoppers were kept in a lowered position when moving. Following the pouring of the floor the pilasters were poured, completing the flume.

This flume, 4,500 ft. in length, has been in operation one year and although it was expected that this flume might leak somewhat at the joints, it has proved to be, for all practicable purposes, watertight, there being very much less leakage through these joints than through the bell-and-spigot flume. The precast

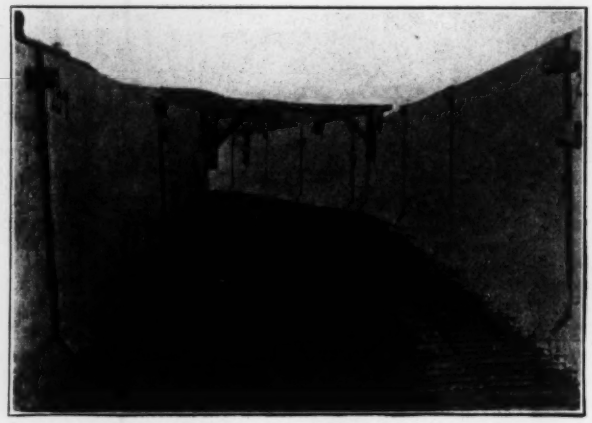


FIG. 14. CLEATS JOINED ADJACENT SLABS OF SEMI-PRECAST FLUME BEFORE CONCRETING

concrete was of an extra good quality, as it was possible thoroughly to tamp and spade it into the forms, making it unusually dense.

The costs of the above described flumes taken from actual cost reports are not comparable as the flumes were of different sizes and the construction work was spread over a period of three years with fluctuating labor and material costs. The difference in the length of haul of materials, local conditions and the season of year in which the construction work was done had a decided effect on the costs.

There is given below a cost per lineal foot for each type of flume with conditions adjusted so as to make the costs comparable. These costs are based on a flume with a carrying capacity of 270 sec.-ft. on a slope of 2 ft. per 1,000 ft. This capacity requires the inside dimensions to be 8 ft. 7 in. x 5 ft., including a 12-in. freeboard for all types of flumes except the all gunite, which had to be increased 11 in. in width to provide for the same capacity.

ADJUSTED COST OF FLUME PER LINEAL FOOT

Bell-and-spigot concrete flume	$12.22
Concrete flume without joints	11.83
All gunite flume	12.40
Combination gunite and concrete	12.10
Semi-precast concrete	11.58

The above are field costs exclusive of excavation and are based on winter construction, 10-mile haul for materials from railroad to job, 2-mile haul for sand and gravel, common labor costing 50c. per hour and skilled labor in proportion, cement $4 per barrel at job, steel 5c. per pound and lumber $70 per thousand. These costs are abnormally high due to the fact that labor was scarce, inefficient and the cost of both labor and materials high on account of war conditions.

The fact that most of the flumes were built during the winter months was a factor greatly increasing the costs. Records show that a reduction of 25 per cent would have been made if the work had been done during favorable construction weather.

The above described construction work was all done by government forces and was carried on under the supervision of A. P. Davis, director, U. S. Reclamation Service, F. E. Weymouth, chief engineer; J. L. Savage, designing engineer; Walter Ward, project manager; A. M. Rawn and E. C. Panton, engineers.

Two Small Dams Good Examples of Amateur Engineering

Correspondents Report on Structures in Different Parts of Country, Both of Which Disregard Good Practice

ON THE same day last month two engineers in different parts of the country, obviously unknown each to the other, sent this journal drawings and a brief description of small dams about to be built. The two cases were alike in that each was an example of amateur, or, at least, unintelligent engineering applied to what might seem to be a small and unimportant structure, but one whose failure might entail serious consequences. Details of the two dams as reported by the two engineers are given herewith.

The first dam is to be built in Ohio and is reported on by Gale Dixon, chief engineer of the Bureau of Water Works Improvement of Akron, Ohio. It is shown in Fig. 1, p. 1019. It is being built immediately above an unsafe mill dam and right near the site of a half dozen other small dams which have washed out at intervals in the past fifty years. Mr. Dixon's comment on the dam is as follows:

"The feature of the new dam which most interests me is the design of the spillway, described in the specifications as 'constructed of reinforced-concrete.' As illustrated in the accompanying sketch, it would be better termed an 'earth embankment with concrete paving containing some reinforcing steel.' The paving slab as reinforced is unsafe for the support of its own weight between the walls after the embankment beneath it has settled.

"The type is such an obvious development of the timber spillway of the forest country that there must have been many such built; yet I have never before happened to observe one, nor do I recollect ever having seen this type illustrated or described in technical literature.

"In the present instance I believe the designer's inspiration came from the spillway of the old mill dam just below, but in that case the word sluiceway would perhaps fit better as the aperture is 8 ft. square and the concrete trough is founded entirely upon the embankment, with no walls running down to original ground.

"The general design of the new dam will bear a word of description. It is being thrown across a creek of 9 sq.mi. drainage area, and will make a pond about 25 acres in extent with 20-ft. depth just above the

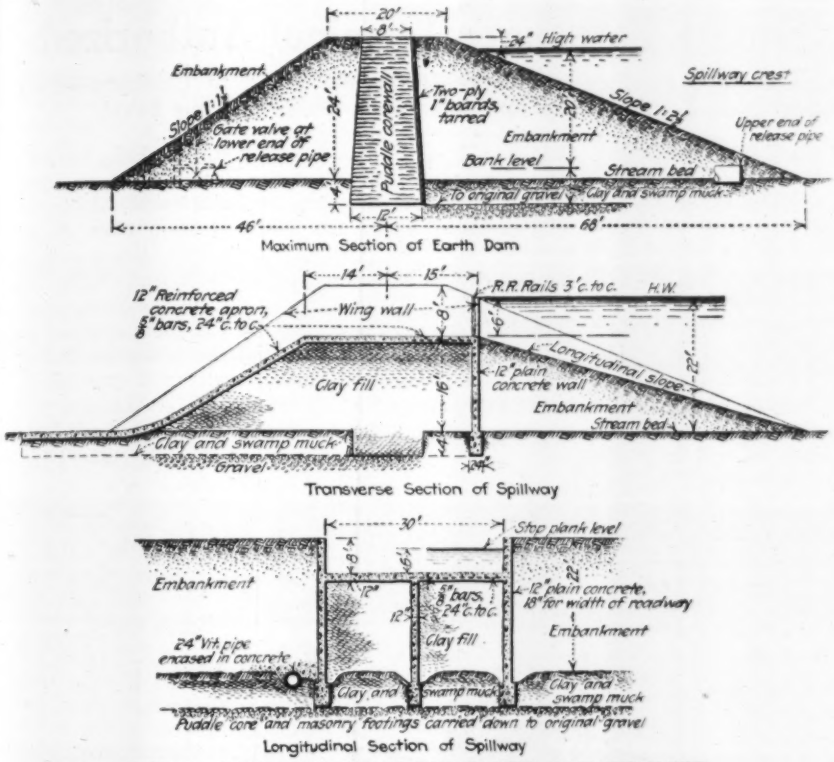


FIG. 1. PAVED SPILLWAY FOR EARTH DAM DESIGNED FOR STREAM NEAR AKRON, OHIO

"I am enclosing herewith sections of a small dam to be constructed near this place. The person having the dam constructed furnished the engineer the general design and gave instructions that the plans be drawn to conform with the dimensions furnished. The question has arisen, Would the dam not give way to heavy pressure upon its completion?

"The engineer recommended on face of plans that the project be condemned or else the dam be fastened securely in the solid rock by means of boring holes in the rock and sinking steel pins of sufficient caliber to anchor the dam, and further that the following specifications accompany the design: All concrete to be of a 2:3:5 mix and to be reinforced where necessary to meet the approval of the engineer; all walls to be firmly cemented to the rock bottom and finished in workmanlike manner; no wall to be more than 8 in. thick except at the south end of the dam, which is to be 6 in. thick, and on north end next to water house, which is to be 12 in. thick; no concrete to be poured in moving water; rock and gravel to be used in walls must be clean or free from dirt, not to exceed 3 in. in dimension. When the contractor learned what the reinforcement requirements would be he threw up the job."

"Note that the borings say that at the bottom of the dam there is solid rock. The stream is sliding along over this rock at the present time, and only has a few angling shoulders which run almost up and down stream. My contention is that the dam will slide, even though the cross-section walls are close enough, which I think is not a fact. I also feel that the loose rock inside the dam will place much strain on the bottom of the walls, and will do more harm than good."

dam, to be used for fishing. The valley floor at the dam site is about 175 ft. wide and has a surface layer of some 14 ft. of soft muck and silt overlying gravel and sand. No cutoff piling is provided and except for the 'puddle core wall' the embankment is placed on the original swamp surface. The specifications do not prescribe the method of forming the embankment, nor do they define 'puddle.' The results in construction may be imagined.

"The release pipe is of vitrified clay incased in concrete with gate valve at the downstream end. The core-wall trench was not carried under the release pipe, and the plans made no provision for the prevention of percolation along the exterior of the relief pipe or the backs of the spillway abutments. No surface protection of any kind is provided for either the upstream or the downstream slope."

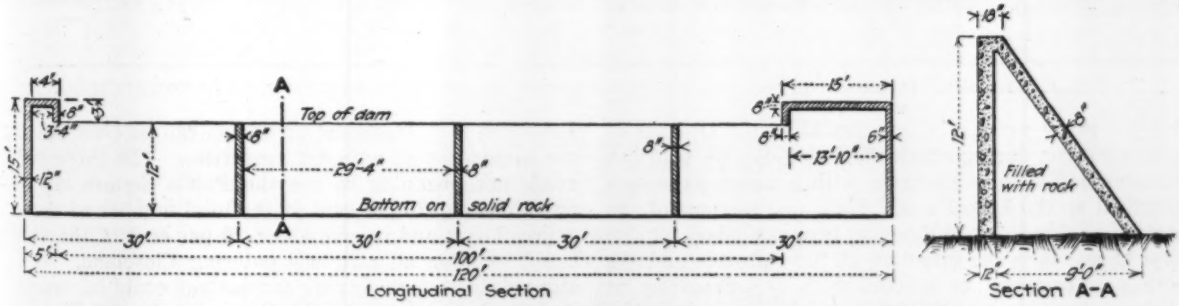


FIG. 2. LONGITUDINAL AND CROSS-SECTIONS OF A PROPOSED DAM IN ALABAMA

The other dam, given in the sketch in Fig. 2, is reported on by Ernest H. Lee, civil engineer and surveyor, Gadsden, Ala. Mr. Lee's letter is about as follows:

Paducah Elects Two Engineers to Commission

Two of the four members of the City Commission of Paducah, Ky., elected Nov. 8, were engineers, Henry A. Pulliam, and L. A. Washington, a former city engineer.

Cleveland Public Square Passenger Terminal Authorized

Commerce Commission Issues Certificate of Public Convenience—Railroads Reply to Criticism—Plans Aim to Distribute and Segregate Traffic—Steam and Interurban Traffic on Same Level

AUTHORITY was granted by the Interstate Commerce Commission, Dec. 7, 1921, to the New York Central, the Big Four and the Nickel Plate railroads, as applicants, to purchase the corporate stock of The Cleveland Union Terminals Co., and to enter into an agreement with the terminal company for the use of the passenger station and its approaches to be constructed by it at the southwest corner of the Public Square at Cleveland, as shown in Figs. 1 and 2. This action reverses the opinion of the commission made public Aug. 12, in which an application was denied. (*Engineering News-Record*, Aug. 18, p. 297.). The commission also issued a certificate of public convenience and necessity with respect to constructing the station. It is believed that this action will now permit the Public Square station project to go forward, following the many years of discussion as to the location of a new station, during which the Public Square plan has been criticised in comparison with a union passenger terminal on the Lake Front. Plans and sections of the station as developed to date are here published for the first time. It is the intention of the railroads and the terminals company to proceed with the financing so that construction may follow as quickly as practicable.

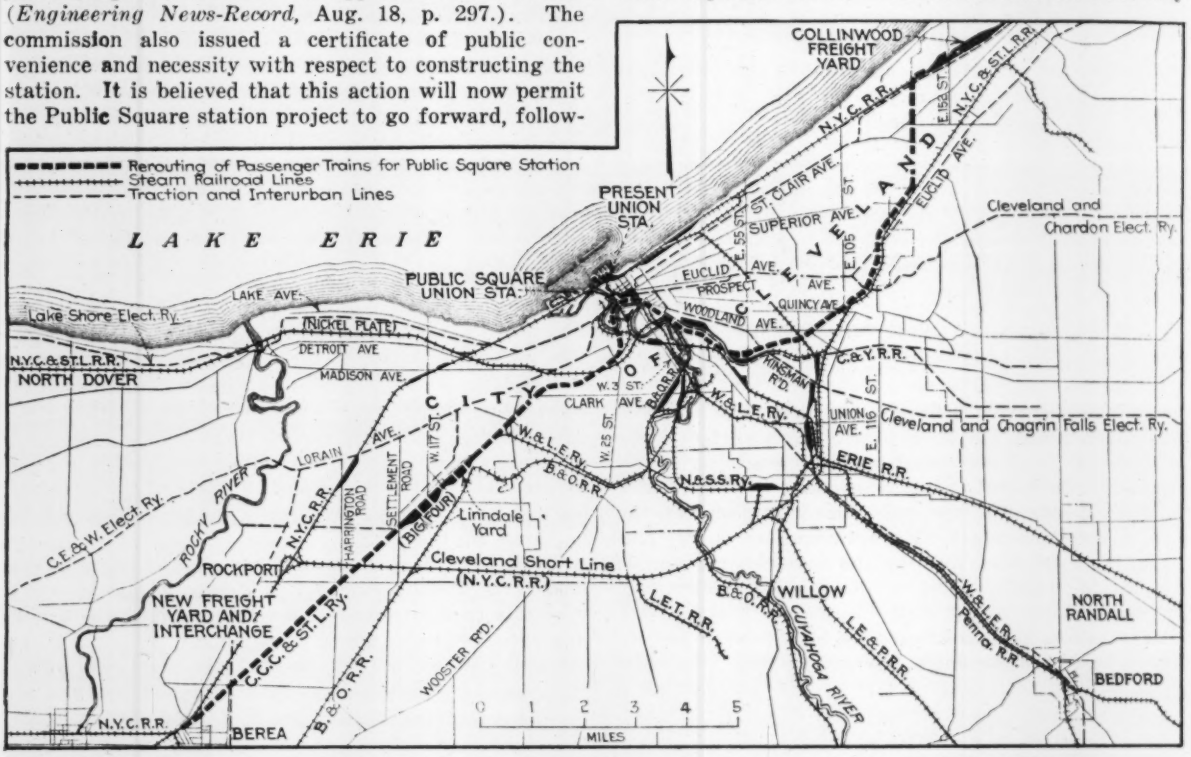


FIG. 1. PRESENT RAILROAD LINES AND FUTURE REROUTING THROUGH PUBLIC SQUARE TERMINAL

Applications were made by the three railroad companies to the Interstate Commerce Commission on Feb. 14, 1921, and public hearings before the commission were held April 19 to 22, 1921. After the first applications were denied the railroads asked for a rehearing, which was held, Sept. 20-27. As negotiations now stand, the new station will be used initially only by the New York Central, the Big Four and the Nickel Plate. The Pennsyivania has stated it will not come into the station project and the other railroads, the Baltimore & Ohio, the Erie, and the Wheeling & Lake Erie, have not yet made a decision. Since the Pennsylvania now uses the present union station on the Lake Front, which is to be abandoned under the Public Square plan, it will probably make its principal passenger terminal at its present station located at East 55th St. and Euclid Ave. Although present negotiations do not contemplate the immediate use of the station by the Pennsylvania, the Baltimore & Ohio, the Erie and the Wheeling & Lake Erie, it is maintained that the site will provide for traffic expansion of all the railroads for the next fifty years and that additional expansion can be obtained by the acquisition of adjacent properties. The three railroads now planning to use the Public Square station operate about 70 per cent of the total number of steam railroad cars and receive about 70 per cent of the total ticket sales on all railroads entering Cleveland. It is also pointed out that track connections could be readily made to bring the Erie, the Pennsylvania, the B. & O. and the W. & L. E. into the new terminal.

The principal arguments presented at the hearing before the Interstate Commerce Commission in favor of the Public Square station were:

1—That new passenger facilities are imperatively needed by the New York Central Lines because of the growth of population of Cleveland and because the present station is old and inadequate; the station and approach tracks are insufficient in number; the station tracks are generally too short; the switching at the station is interfered with by other operations; the station is inconveniently located, being

away from the business section of the city and from good street car service.

2—That the passenger traffic on the Lake Front line interferes with freight operations and the service to industries and the freight operations slow down the passenger movements.

3—That the present lines of the New York Central through Cleveland along the lake front and around the southern part of the city are congested.

4—That additional tracks along the lake front can only be obtained at very heavy cost and to the injury of the parks and industries which hem in the railroad on either side.

5—That additional tracks along the Cleveland Short Line can only be obtained at heavy cost because of tunnels, widening the viaduct over the Cuyahoga River, bridges over streets and adjacent parks.

6—That the lake front is an industrial section and should be kept free of passenger traffic so as to provide proper freight service for future industrial growth and for the rail and lake interchange when the city carries out its waterfront development.

7—That the passenger traffic should be removed from the lake front line to a new line so as to leave the present lines free for through freight and local and industrial traffic.

8—That there is not sufficient space on the lake front for future growth of the passenger terminal as well as increase of freight facilities required for growth of industrial business.

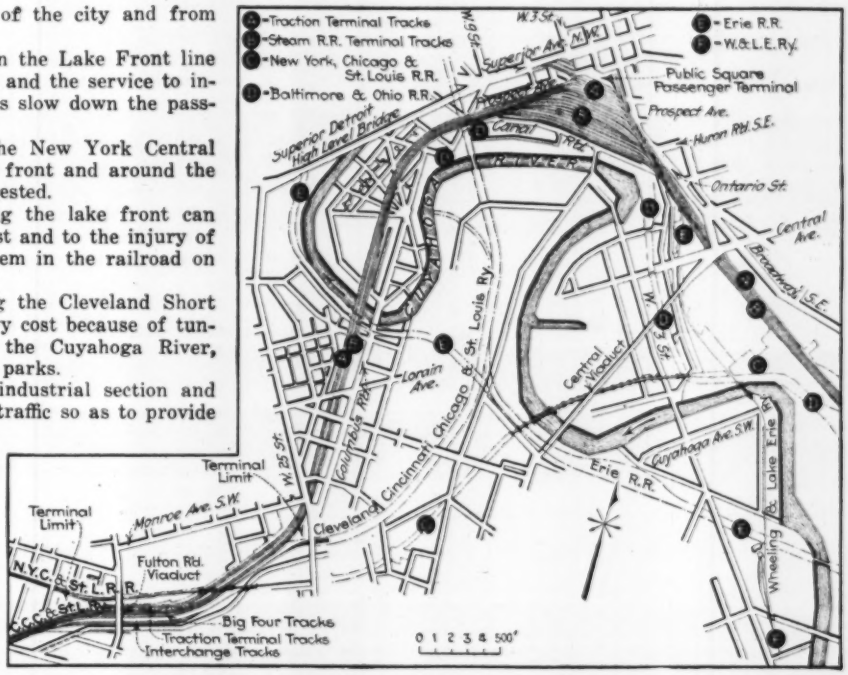


FIG. 2. APPROACHES TO PUBLIC SQUARE STATION WITHIN TERMINAL LIMITS

9—That the Public Square station is the most convenient for the public, being near the business and office centers and on the main street car lines.

10—That it is so situated as to be readily accessible for all the railroads.

11—That there is ample space for future growth of station facilities.

12—That the interurban and rapid transit lines will be in the same terminal with the steam lines and that they will develop the short haul business, leaving the steam railroads free to handle the long haul business.

13—That the new route for passenger trains in connection with the Public Square station will solve the congestion difficulties of the New York Central Lines while the lake front plan will not do so.

14—That the complete Public Square project can be carried out more cheaply than any other known plan that will solve the congestion problem of the New York Central Lines.

The engineering plans prepared jointly by the railroads and the terminals company call for but one track level—30 ft. below normal street level—instead of segregating traction and steam railroad traffic on two levels as proposed in earlier studies. It is also the aim to distribute and segregate the traction and steam railroad passenger traffic by providing independent concourses and passageways, in so far as possible, and to segregate non-passengers passing through the station by providing separate accessible passageways.

Since the adoption by popular vote of the City of Cleveland of the ordinance on Jan. 6, 1919, authorizing the construction of the Public Square Terminal, the original plans and the method of operation contemplated have undergone considerable revision. It is now planned to have initially nine station platform tracks for traction lines and ten station platform tracks for steam railroad lines on the one level. A coach yard is also

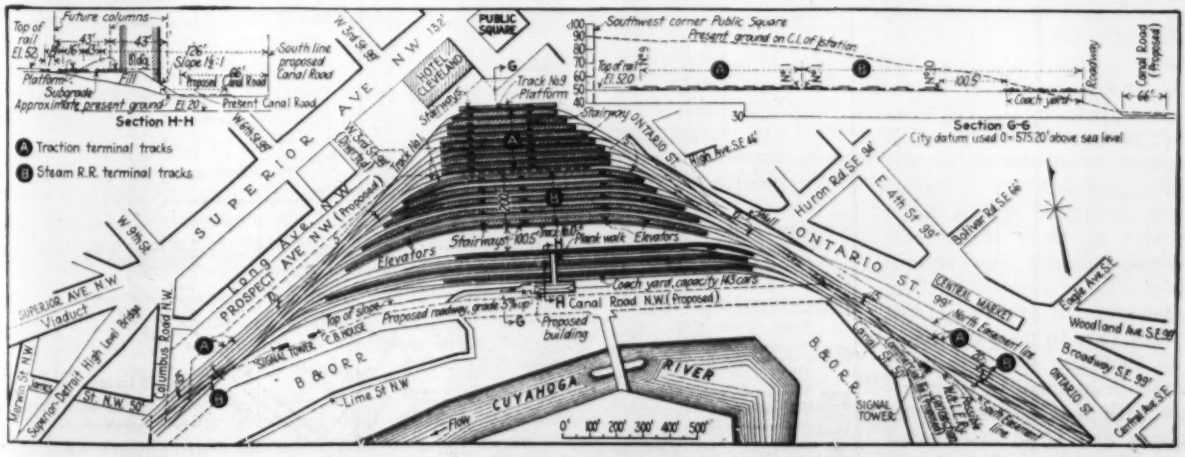


FIG. 3. TEN STEAM LINE AND NINE RAPID TRANSIT TRACKS PROVIDED IN INITIAL LAYOUT
Nine-track coach yard, later to be removed to outlying point, to occupy part of space for thirteen additional steam line tracks for future expansion.

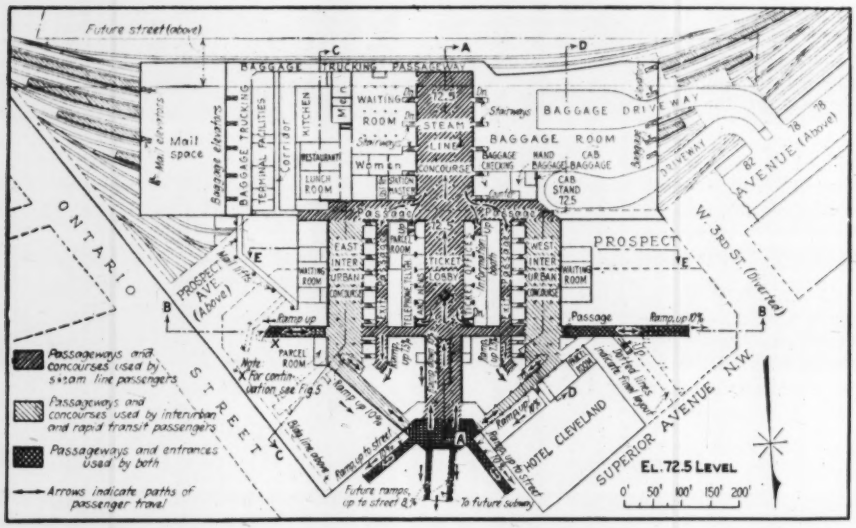


FIG. 4. CONCOURSE LEVEL—DIVISION OF PASSENGER TRAFFIC—RAMP APPROACHES

provided in the terminal, paralleling the platform tracks and occupying a space later to be used for expansion of steam railroad facilities to a total of twenty-three tracks. Plans for approaches and connections from the outer terminal limits are practically the same. Plans for the station itself have been made with a view to the greatest convenience for the public and to obviating the objection raised that congestion would be caused by adding the station traffic to that already existing at the Public Square.

For about twenty years new passenger station facilities have been the subject of controversy in Cleveland and the adoption of the Public Square plan by popular vote, Jan. 6, 1919, followed the previous adoption of a plan to locate a Union passenger terminal on the lake front. It was first proposed to build a stub-end, two-level station at the Public Square; then a two-level through station, and now plans developed by the railroads and the terminal company provide for a one-track-level through station. Since 1918 there has been a spirited controversy in Cleveland over the rival lake-front Public Square project. A comparison of the two plans appeared in *Engineering News-Record*, Jan. 30, 1919, p. 240, with editorial comment in the same issue criticising the Public Square project.

In answer to the criticism that congestion would be increased by a station at the Public Square, the railroads have contended that a large portion of their traffic now passes through the square since a large number of their passengers transfer there from station cars to main car lines, and that the steam railroad traffic is so small in comparison with that now using the square and is so distributed over the twenty-four hours that its addition would have little effect. Since interurban and rapid transit cars now terminating at the Public Square run at infrequent intervals, the railroads point out that passengers collect in the square while waiting for trains, and that if these lines terminate in the proposed station, all this traffic will be removed from the street surface, and further, the interchange of passengers between these lines and the steam railroads will take place without the passengers going upon the street surface. It is also maintained by the railroads that the Public Square is an exceptionally large open space that can accommodate vastly greater traffic than it now does if properly laid out and if traffic is properly handled; that there is now more confusion than congestion at the square due to the return looping of all cars at this point and the operating of cars against the normal currents of traffic; that traction passengers traveling between the east and west sides of the city are forced to transfer in the Public Square or if they go only a short distance beyond the square have to leave the cars and continue their trip on foot; that in order to obtain a seat during the evening rush the people walk to the square to take the cars instead of taking them along the line; that the present difficulties at the square would largely be avoided by through routing of cars to points beyond the square; that the entrances and exits of the station are so located at points exterior to the Public Square proper as to divert traffic away from the square only one of the five entrances being directly on the square; that a future subway under the square, which has been heretofore proposed by the city, and additional viaducts between the east and west sides of the city, as are proposed, will remove much traffic from the square.

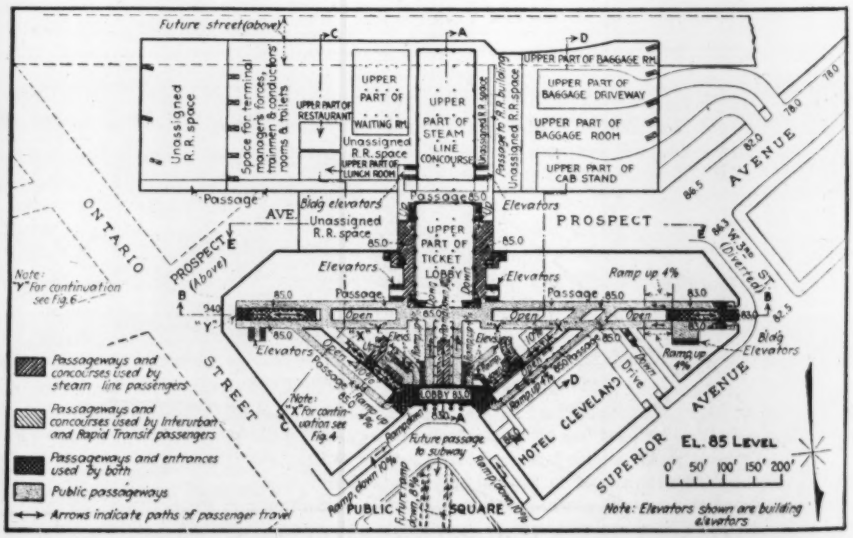


FIG. 5. NORMAL STREET LEVEL—PUBLIC PASSAGES THROUGH ARCADES

In answer to the criticism that the Public Square site would not afford opportunity for the necessary expansion of railroad facilities in the future, an analysis was presented to the Interstate Commerce Commission by the New York Central indicating that space is provided in the present plan for additional facilities to meet the requirements of all of the railroads entering Cleveland for the next fifty years at the present rate of passenger train increase of 1.33 per cent compounded annually, and that additional space is available for further expansion. It was not considered feasible by the railroads to locate the station adjacent to the east approach tracks east of the Public Square, since existing streets, large industrial plants, the Cuyahoga River, and other railroad properties already developed, restrict the space necessary for expansion. In reply to questions raised as to the economic soundness of monumental passenger terminals at the cost of millions of dollars, it was stated by the railroads that the plans for the project as now worked out in detail do not call for a monumental structure, but only for the railroad facilities required, and that structures above the street level will be commercial buildings from which revenue will be derived, with station entrances and exits through them.

With the track level below the concourses and the development of extensive air rights over the terminal itself, electrification will be necessary. The probable limits of electrification and points of changing power will be at Collinwood on the east and at Linndale on the west. The rerouting of New York Central passenger trains from the lake front main line is shown in Fig. 1, and in this connection it is the present intention of the New York Central to route its westbound freight over the present lake front line and eastbound freight over the Cleveland Short Line, using the Nickel Plate eastbound track between Quincy Ave. and Superior Ave., jointly with that road. For the present, the principal construction work necessary for approaches, involving the use of the terminal only by the New York Central, the Nickel Plate and the Big Four, would be the grading, viaduct, bridges, and trackage on the west approach from about 25th St., over the Cuyahoga River valley into the station, and on the east the building of additional approach tracks with heavy grading and retaining walls paralleling the Nickel Plate from the terminal limits and continuing into the station.

Within the switching limits of the terminal, the plans call initially for four approach tracks for steam railroad traffic and two tracks outside of these limits. Calculations of the New York Central indicate that enough trackage has been provided at the throats and on the approaches, but it is stated that additional approach tracks for steam railroad traffic can be obtained by temporary or permanent use of traction line trackage if required on account of congestion, and by the construction of additional tracks if needed. Maximum grade on the approaches is 0.72 per cent, which is the ruling grade on the Big Four in this locality. Maximum curvature on the approaches of 4 deg. 40 min. occurs on the curve just west of the terminal.

As indicated in Fig. 3, ten steam railroad platform tracks are provided in the initial layout for a maximum peak traffic of twelve trains in the station during the busiest hour, and six trains in the station at one time. Of the three railroads using the station, eighty trains per day under present schedules would be handled. It is pointed out that ninety-eight trains per day are handled through the present lake front station on nine platform tracks, some of which are short. The three railroads consider the final track layout adequate for future expansion since it provides an increase of 130 per cent in the number of platform tracks, and if the number of trains continue to increase at the same rate as for the past eight years, namely, 1.33 per cent compounded annually, the layout would provide for a normal growth of sixty-three years. If all of the railroads entering Cleveland should use the terminal, there would be 152 trains per day on present schedules; 25 trains in the station during the busiest hour, and 9 trains in the station at any one time. In this case it is stated that the initial platform tracks will probably be increased to twelve in number, and the final layout would provide for an increase of 90 per cent, sufficient for normal growth of traffic at the present rate for forty-nine years. The station area can be extended southerly in the future to provide further expansion of track facilities. Should it become necessary, it is contemplated that four of the traction platform tracks would be taken over for steam railroad purposes.

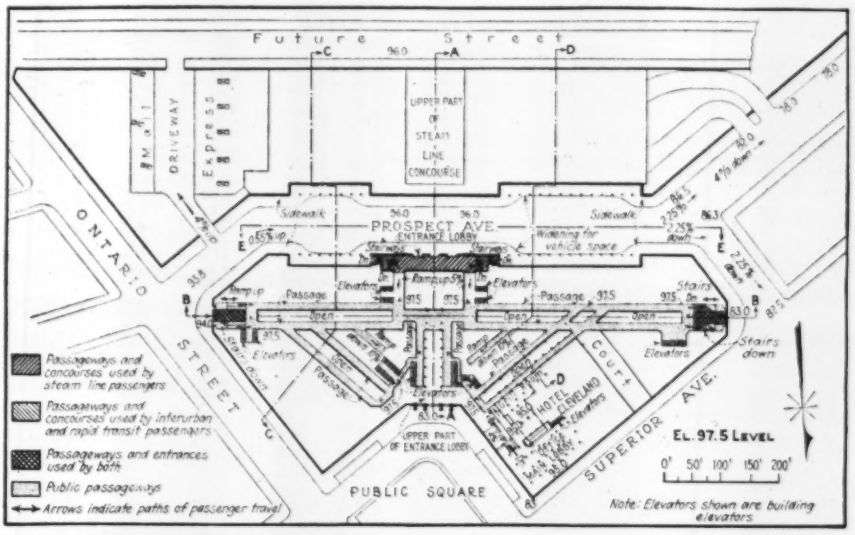


FIG. 6. PROSPECT AVENUE ENTRANCE AT LEVEL 97.5—UPPER PASSAGES

It is proposed to lease to a company known as the Cleveland Traction Terminals Co., those portions of the passenger terminal to be used for interurban and rapid transit purposes, as well as the concession space and the right to use the joint area. Nine interurban and rapid transit platform tracks are proposed initially, and provision has been made for additional station tracks and platforms for this service. Tracks on the approaches for the interurban and rapid transit trains—two

initially and four finally—will extend to the terminal limits, approximately two miles from the center of the station, and beyond these points it is planned that trunk lines will be constructed from which branches will connect with suburban developments to relieve the steam lines of this traffic. It is pointed out that the Shaker Heights rapid transit line, already in operation, can readily be connected to the terminal, having been constructed with this in view.

The principal considerations in the layout of the station, as developed in plans shown in Figs. 4, 5, 6, and 7, have been (1) to fit the floors in with different levels of streets; (2) to segregate steam railroad from traction passenger traffic, in so far as possible, and (3) to segregate non-passengers passing through the terminal from passengers. The concourse level—El. 72.5—which is shown in Fig. 4, is reached from the Public

steam railroad lines are provided between each pair of tracks and for the traction lines between each two tracks. The location of mail and baggage elevators is indicated in Fig. 4, which also shows the baggage trucking passageway around the rear of the station over the track and platform level. The purpose of this arrangement is to minimize the amount of trucking necessary on track platforms in order not to interfere with passenger traffic.

Segregation of passenger traffic is indicated by the legend on Figs. 4, 5, and 6, showing areas and passageways used jointly by steam railroad and traction passengers, by steam railroad passengers only, and by traction passengers only. Figs. 5 and 6, together with Fig. 7, showing sections and elevations, indicate provision for non-passengers passing through the station (see legend, Figs. 5 and 6). Experience in the larger

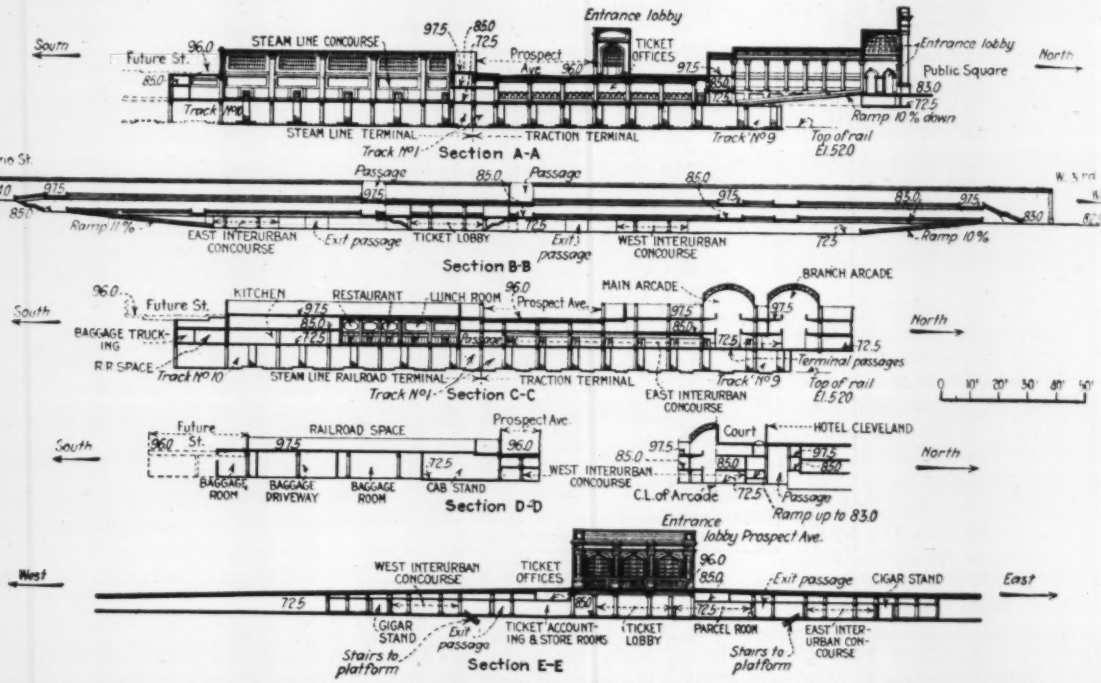


FIG. 7. SECTIONS SHOW NECESSITY OF MEETING DIFFERENT STREET LEVELS (SEE FIGS. 5 AND 6)

Square, Ontario St., and West Third St. (diverted) by ramps downward, and from Superior Ave. by a stairway from El. 83 to El. 72.5. A stairway is provided at the Ontario St. ramp from El. 94 to El. 85, since the street elevation at this point is higher than at the other location above mentioned. Access to the concourse level from the Prospect Ave. entrance, El. 96.0, is gained by stairways on either side of the entrance lobby, connecting with short passages, and thence by other sets of stairways down to the ticket lobby, from which the steam railroad concourse is reached directly. Separate concourses for interurban and rapid transit traffic are located on both the east and west sides of the station, connected by direct passageways with the Public Square entrance. The interurban and rapid transit concourses are also reached by joint passages from the Ontario St., the Superior Ave., and the West Third St. entrances. Track platforms, El. 52.75 (top of rail being at El. 52), are reached directly by stairways from the concourses at El. 72.5. Platforms and stairways for

passenger terminals, notably the Grand Central Terminal in New York City, has demonstrated that a large number of people will inevitably pass through a terminal of this size, fronting on two or more streets and located in a busy part of a city. It was therefore considered important to segregate non-passenger pedestrians passing through the terminal from the passenger traffic. The principal passageway for this purpose will connect the West Third St. entrance at normal street level, El. 83, with the Ontario Street entrance, a stairway being provided at the east end to connect the Ontario St. entrance at El. 94 with the passageway at El. 85.0 and two stairways at the west end to connect the West 3rd St. entrance with the passageway at El. 97.5. A branch passageway is carried to Superior Ave. at normal street level, El. 83, and two diagonal passageways as well as two shorter passageways alongside the entrance lobby, connecting the main passageway with the Public Square entrance at El. 83 are also provided. The main and diagonal passageways will be built in the

form of double deck arcades with corridors on both levels on each side of a central opening over the terminal passageways as indicated by section C-C, Fig. 7. Single ramped passages will also connect the Public Square entrance with the main passageway at El. 97.5, and branch passageways will be provided off the main passageway at this level. Along each pair of corridors, at Els. 85.0 and 97.5 and along portions of the terminal passages at El. 72.5, space for shops or other purposes will be leased.

The terminals company has not yet made any plans for the construction of buildings above the terminal south of Prospect Ave., and will only construct the necessary terminal facilities in this area. Columns and foundations, however, will be designed to carry buildings of possibly eleven stories in height above the street. These buildings would have direct connections into the passenger terminal where feasible. A direct connection by stairway and ramp will be provided between the existing Hotel Cleveland and the west traction passageway.

In the area between Prospect Ave. and the Public Square and along Ontario St. east of Prospect Ave., buildings will probably be constructed about the same time the terminal structures are built. The building at the southwest corner of the square may possibly be twenty stories above the street and the others somewhat lower. The areas above the terminal may be developed by the terminals company or leased for the construction of buildings as has been done in the case of the areas over the Grand Central Terminal, New York City.

The plans for the project have been worked out in collaboration between the three railroads, by George A. Harwood, assistant to the president, and H. D. Jouett, terminal engineer, New York Central Lines, and the Cleveland Union Terminals Co., represented by W. E. Pease, chief engineer of the Cleveland Union Terminals Co.

Maine's Road Maintenance Costs

Road maintenance work in Maine during 1920, according to the annual report of the State Highway Commission, was performed generally by patrol maintenance; 494 patrolmen were employed in caring for 4,241.11 miles of road in 495 towns. Of this mileage 709.34 miles was improved state highway; 949.99 miles was improved state aid highway; and the balance of 2,581.78 miles was unimproved road. There was also maintained by special arrangement with the towns 159.97 miles of improved state-aid road.

A total expenditure for labor and material of $765,073.18 was made on this work, including $18,130.43 furnished by the state for road machine work. The state also furnished supervision and inspection for the work amounting to $34,047.51, making the total gross expenditure chargeable to maintenance of $799,720.69. Of this amount the state furnished $562,252.74 and the cities and towns furnished $237,467.95. The average expenditure per mile was $181.71.

On the 709.34 miles of improved state highway, the expenditure for labor and material and supervision was $374,085.26 or an average expenditure per mile of $527.37. The expenditure on the 3,531.77 miles of other road under patrol for labor, material and supervision was $399,306.29 or an average expenditure per mile of $113.06.

Practical Public Administration Under a City Manager

Human Element, Not Profits Governs in City Work

Success Conditioned on Equipment, Men and Personality

THE chief problem in the city-manager form of government is the city manager and his success is conditioned on the equipment with which he must work, on the personnel of his organization and on the personality of the administrator, said E. J. Fort, city manager, Niagara Falls, at the recent convention of the City Managers' Association in an analysis of the problem of public administration under the city-manager form of government. "The present managers do not perhaps measure up to their jobs and are not the supermen or the highly endowed specialists they have need to be," said Mr. Fort, but prospects of permanency and success are not yet such as to attract the highest type of business managers. The rewards do not yet compare with those in commercial life, and the opportunities for a career are not sufficiently sure and satisfactory to attract the highest grade of talent and to induce men to make it a life undertaking. The necessary qualities of a city manager are much the same as those generally set forth for captains of industry. The manager "must be essentially an idealist, imaginative, enthusiastic, more or less impulsive, intensely human, a dreamer of dreams with the power to make the dreams come true—in short, an artist capable both of great imaginative conception and fine technical execution; possessed both of the power to conceive and to do."

Further views of Mr. Fort on the three factors which in his opinion make a successful municipal administration follow:

Equipment. — The equipment with which the administrator of the affairs of cities must carry on his work is composed primarily of state laws, municipal ordinances and especially the charter of the city. Fortunately, the general form of the charter which we believe lends itself most readily to the proper and efficient admintration of a city has been well worked out and needs only adaption to the laws of the state, but the general ordinances of the average American city of the second or third class are a heterogeneous collection of rules relating to many matters, some of which have little relation to public convenience or welfare. For the satisfaction of his own pride in his work, in the interest of the city and in furtherance of his success, the administrator should see that such ordinances are revised and embody the latest and most progressive ideas upon all matters with which they deal. In order to do this successfully, he must be personally familiar both by study and experience with the methods of dealing with such matters which have been found to be most satisfactory by cities which have passed through the stage of growth and development through which his city is passing. He should be experienced in writing ordinances, building codes, zoning and other restrictions, contracts and specifications. He should have a fair understanding of contract law. He need not be a specialist in either law or engineering, but it will be vastly to his advantage if he is reasonably familiar with them as they apply to municipal problems and can arrive independently at correct decisions in regard to matters with which they deal and which are constantly up for consideration.

Personnel. — For the personnel of the organization with which the administrator must work, I do not assume that, in the majority of our cities, he will be able to secure the services of well trained specialists as the heads of

bureaus and departments in all cases; men who are well versed in the administration of the offices and the technique of their work; who can decide unerringly questions of procedure, equipment and organization, and as a consequence, the final decision upon many of such questions, even in relation to minor details, must fail to him. This in itself is a problem of some difficulty and importance and upon its correct solution depends the smooth and satisfactory operation of the departments. The mental equipment required for this purpose cannot be acquired in a correspondence school or from a short course in a school of public administration, but must be acquired in the hard school of experience. I thoroughly believe that the one selected to be the head of a department should be allowed and required to administer the affairs of that department in all its details and should be held responsible for results. He should not be allowed to lean too heavily upon his superior in matters of detail or in anything except the more important matters of procedure and policy. Credit properly goes with responsibility.

Loyalty, First Requisite

Personality. — Were I to name the qualities which should attach to the head of a department and which should determine his selection, I should unhesitatingly place first in order, loyalty—loyalty to the interests of the public which he serves, that attitude of mind which prompts him to judge of the merits of an act or method of procedure by the manner in which it serves the interests of the public, loyalty to his superiors, sympathy with their purposes, the results which they aim to accomplish and the methods which they propose to pursue in accomplishing them, loyalty to his task. The man is loyal to his task who places the success of his work and the service which he renders through it above consideration of self, whose mind is not busy with schemes for his own advancement and aggrandizement, but whose reward is in doing most efficiently the thing which he has in hand.

I should place second in order, integrity, without which he is worse than worthless in any position of trust or responsibility.

Third is industry. Higher standards of living are constantly compelling city governments to undertake new duties and to perform the older ones more efficiently and economically. The appetite for service grows by what it feeds upon. At the same time, the expenses of government are constantly increasing, debt limits and limits of taxation fixed by state laws loom ominously in the foreground and higher rates of taxation are frowned upon by the public. The chief of a department, in order to reconcile these conditions, must therefore not only be diligent in the performance of the duties of the day, but he must be diligent in informing himself as to what others in his own line are doing. He must keep abreast of the times and preferably ahead of them and, in doing so, in almost any branch of municipal work I venture the assertion that he will have need to extend his working hours far beyond those of the employee who watches the office clock.

Fourth in the order of importance is education and experience. Native ability and other personal attributes may equip one man without education and experience better for the duties of the head of a department or chief of a bureau than do the education and exerience of another. However, this is the exceptional case. It has been said that a goat cannot be educated to be a sheep, but he can by this means be made a much better goat. Education and experience are indispensable for the heads of certain technical departments, such as the city engineer, the corporation counsel and the health officer.

The fifth place I would assign to tact. There is no department of the public service in which the official head is not obliged to deal with the public. It is the public's business in which he is engaged. It is well to remember that the public is not too well informed as to the details of its business and through lack of information or misinformation the official acts of the administrator are likely to be misjudged. On the other hand, his reputation and influence in the community, his success in his undertakings and ultimately his tenure of office depend upon the good will of the community. It would seem to follow, therefore, both from reasons of principle and from reasons of policy, that his attitude toward the public should be carefully considered and should be correct. He should be endowed with and should practice a never failing courtesy which shows no distinction between the rich and the poor, the wise and the ignorant, friend and supporter and bitterest opponent.

Tact in dealing with subordinates is also of first rate importance, for without it the administrator will not generally receive their full co-operation and enthusiasm in their work which springs from esprit de corps. By it many a large undertaking has been carried through to success. In most cases this success has been the result of the tact of the head of that organization in the treatment of its members in such a manner as to arouse their enthusiasm for success. The manager's pathway to success will be doubly difficult if he lacks a proper appreciation of the importance of the enthusiastic support of his organization.

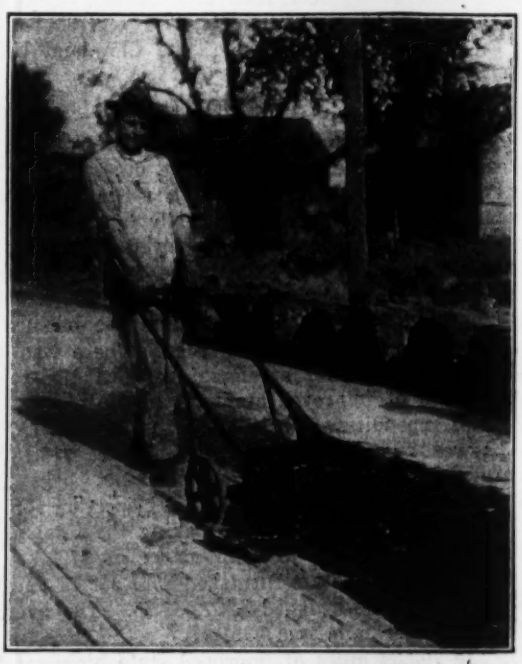
I assume that every man who is fit for a position of responsibility has learned the lesson of a respectful and tactful attitude toward his superiors and that it does not need discussion.

Wide Asphalt Joints Not Essential in Brick Pavements

For Lugless Brick Unnecessary Worry and Expense Incurred To Secure Uniform Spacing— Squeegee Joint Filler

By Harlan H. Edwards
City Engineer, Danville, Ill.

VARIOUS engineers and inspectors on brick road construction where lugless brick and asphalt filler have been used have voiced considerable complaint recently because of the apparent difficulty encountered in filling every joint between every brick its entire depth with asphalt. They bewail the fact that the lug brick has been abandoned and declare that the pavements will not give good service because the bricks sometimes lie so close that the filler cannot penetrate between them.



HOT FILLER IS FED INTO CRACKS AHEAD OF SEMI-CIRCULAR SQUEEGEE

A careful review of the facts in the case, however, indicates that the admonition "fill every joint from top to bottom" when cement grout filler is used, has been so well learned that the real function of the bituminous filler has too often been lost sight of.

Flexibility, cleanliness and the elimination of expansion stresses are the greatest points in favor of the asphalt filler. The first and the last points were fulfilled by the sand filler, with which many of our oldest and best brick streets were constructed, and in which, incidentally, lugless brick were used. Protection of the edges of the brick at the points was not afforded by sand and the item of cleanliness was not seriously thought of. Bituminous fillers, however, fulfill all the conditions demanded, and in addition have the advantage of reducing wear at the joints and of being quiet and clean, which in these days of greater sanitation is an important item.

Wire-cut lug and repressed brick with lugs were used when bituminous fillers were introduced, and they continued in favor until it was seen that with the wide joints the filler was "cut out" by traffic, thus permitting the cobbling of the edges of the brick in a short time. To eliminate these bad features the lugless brick and the vertical fiber brick were gradually adopted, and their use has met with much favor.

From the standpoint of permanent smoothness and continuity of surface as well as cleanliness narrow joints are desirable. Where brick are in such close contact that even liquid asphalt at high temperature will not penetrate the joints, it is folly to worry. Since close contact reduces the cobbling or wear of the brick at the joints and cuts down the wearing of the filler from the joints, it makes for a smoother, longer lived surface and a lower annual maintenance cost to have the narrowest joints possible.

The assumption that bituminous filler produces a waterproof pavement is not true. An examination of many pavements at different intervals shows that the sand cushion or bedding course under the brick is always wet after a rain. It shows also that contraction of the surface in cold weather produced cracks between bricks and the filler which are sometimes large enough to admit a knife blade. Manifestly, then, the idea of waterproofness is erroneous and the need on this account for filling every joint, however small, with bituminous filler, does not exist.

Many bituminous-filled brick pavements have been constructed with uniformly good results, and the best of them all are those in which lugless and vertical fiber brick were used. Various methods of applying the filler have been used, all of which are good.

Applying Filler

For use in cold weather, either the conical pouring cans or the hot iron squeegees have proved their worth, but for general use during the warmer construction season the cheapest and most reliable method of application has been by the use of the combined rubber squeegee and asphalt pot. In this contrivance the hot filler is kept in a square metal box mounted directly above the squeegee, which is semi-circular in shape. The filler is applied from the box to the pavement through a hole directly in front of the squeegee. All the joints are filled at once with the hot asphalt while the excess material is always drawn forward with the machine by the semi-circular squeegee. Little time is afforded for the filler to cool before it gets to the bottom of of the brick. Good work has been done by this method with the temperature as low as 20 deg. F.

Many of us are prone to make a big fuss over little unessential things while at the same time we disregard the larger things which are really the controlling factors in determining whether or not the pavement as laid will give its proper service. Contrary to the characteristics of the cement grout filler, bituminous filler will not permit stresses which will "pop off" the tops of the brick in hot weather if it penetrates but a fraction of the entire depth of the brick. In consequence it is not so essential that the sand cushion be such that it will not work up part way between the brick under the roller, and thus prevent a full penetration of the filler to the entire depth of the brick. Full penetration is desirable, but not so much so that it would warrant an increased cost or a sacrifice of wearing qualities of the pavement to insure it.

Precast Stone Trim Produced For Baltimore Refinery

Casting and Storage Yards Elaborate—Batch Cars on Elevated Track Chute Concrete to Forms—Daily Output 600 Cu.Ft.

By J. Roscoe Sharp
Foreman, Stone & Webster, Inc., Baltimore, Md.

THE plans for the refinery of the American Sugar Refining Co. at Baltimore, Md., contemplated the use of precast stone trim, more commonly referred to as cast stone. For the entire project, planned requirements were 40,000 lin.ft., or approximately 30,000 cu.ft.

The plant was designed on the basis of meeting the complete requirements within three months, and consisted (1) of an electrically-driven mixer of a capacity of 10 cu.ft., with attendant storage for concrete materials, elevated 5 ft. above the level of an industrial track; (2) two industrial tracks of a 24-in. gage, leading from the mixer up and 8 per cent incline to two parallel trestles 50 ft. apart, each 400 ft. long and elevated 5 ft. above the ground; (3) two industrial bottom-spout hopper cars; (4) a crane with a 30-ft. boom; (5) 1¼-in. water lines along each trestle, and (6) two 15-ft. plank roadways each 400 ft. long, for operation of crane and portable wooden concrete chutes.

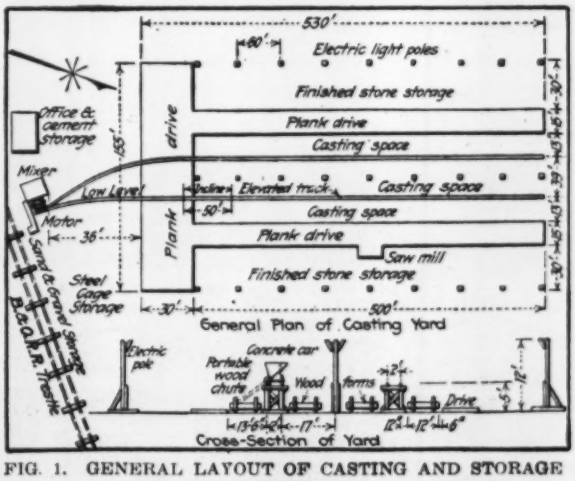


FIG. 1. GENERAL LAYOUT OF CASTING AND STORAGE YARD

Fig. 1 shows the general layout of the casting and

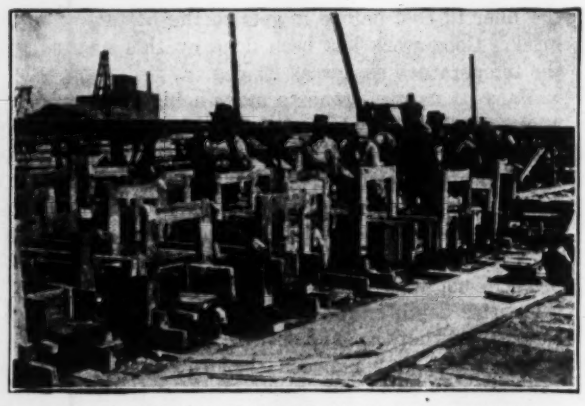


FIG. 2. SETTING THE PRECAST STONE FORMS

storage yard, and Fig. 2 a general view of the forms. The forms were built knockdown of 2-in. material, and were held in place by yokes made of 2-in. x 4-in. pieces and ½-in. diameter rods threaded at both ends. The form bottoms were set about 18 in. apart to give working space, and leveled on 4 x 4-in. sills. Sides, ends, and yokes were put on by carpenters and the whole again leveled and squared.

To insure a good face, all stone was cast face down. One inch of 1:2 mortar was first placed in the forms, then the reinforcing, consisting of four ½-in. bars made into cages using No. 1 wire. The 1:2:4 concrete was then placed by laborers, by chuting from the car on the elevated track through the wooden chutes. After finishing off the concrete, the stone was covered with burlap bags kept wet to prevent hair cracks. Twenty-four hours later the side forms were stripped and the stone was turned over onto 4 x 4-in. sills. This operation left the stone face up convenient for finishing. The finish was a neat cement wash applied by cement finishers with hardwood floats. After finishing, the stone was again covered with burlap bags kept wet.

At the end of four days the stone was handled into storage by the crane. All stone except those with a return face were cast with holes in the ends for convenience in handling with chain dogs. The storage piles were kept wet for ten or more days to insure the curing of the stone.

When the forms were erected, a linen tag was attached to each, giving the number of the stone. This number was transferred to the stone, using paint, just before stripping the forms. The system of numbering was such that all pieces of one section and one length had the same number, regardless of its location on the building.

The force employed consisted of thirty carpenters, thirty-six laborers, fourteen cement finishers, two crane engineers, and one general foreman. The output was 800 lin.ft. per day.

The construction work was done under the supervision of the construction board of the American Sugar Refining Co., C. T. Main, designing engineer, and Stone & Webster, general contractors.

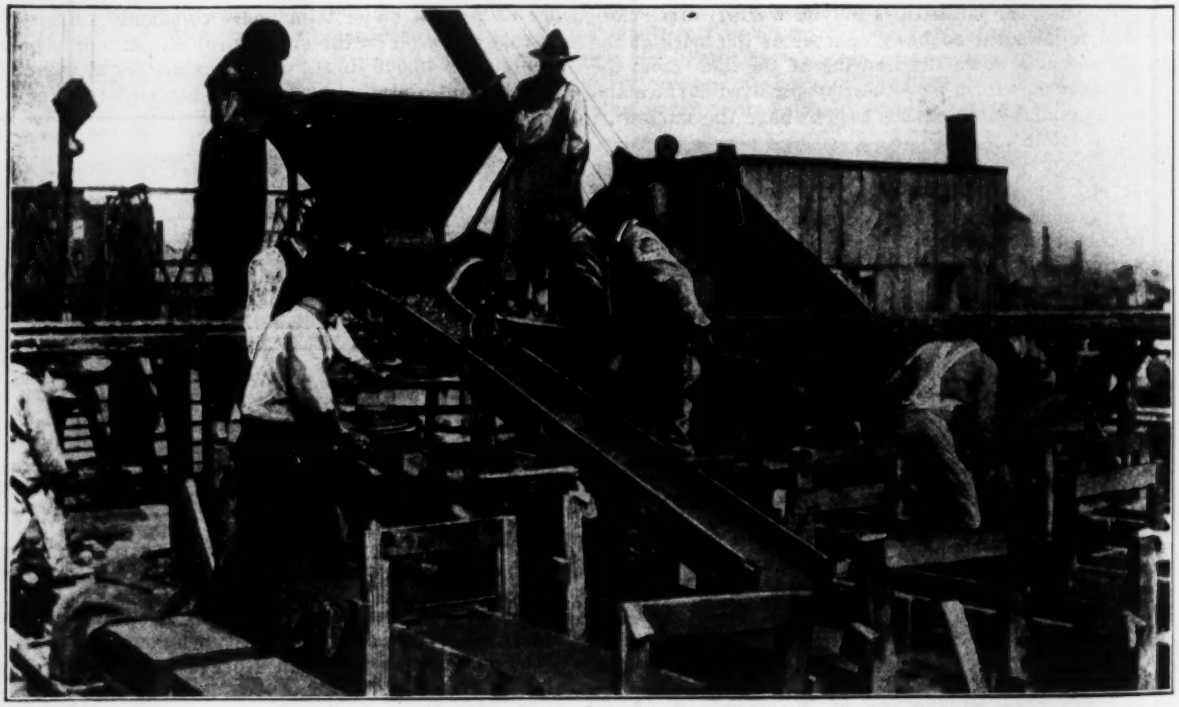


FIG. 3. ELEVATED BATCH CAR CHUTING CONCRETE DIRECT TO FORMS

Geological Survey Activities

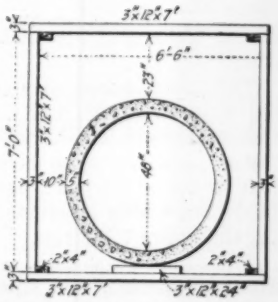
The work of the United States Geological Survey for last year included detailed geologic surveys of 4,600 sq.mi., reconnaissance geologic surveys of 21,500 sq.mi., exploratory geologic surveys of 18,000 sq.mi., co-operative geologic work with seventeen state organizations, studies of ore deposits in ten states, oil and rock surveys in ten states, geologic surveys in Alaska of 1,500 sq.mi., and the continuation of studies of mineral deposits in Alaska. Other important work included topographic surveys in the United States of 12,311 sq.mi., running of 4,796 miles of levels, establishing 1,123 benchmarks, and making 576 mi. of river surveys.

Concrete Pipe Line Augments Kansas City Water-Supply

Pipe Made on Site Hauled by Crawler Tractor Over Soggy Soil and Placed in Tunnels with Home-Made Derrick Car—Water-tightness Tests

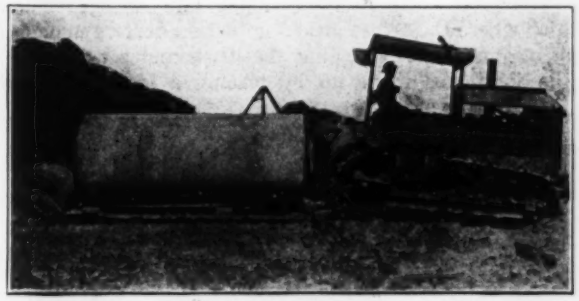
By Frank E. Miller
Assistant Engineer, Water Department, Kansas City, Mo.

With the new 48-in. concrete gravity conduit between Quindaro and the Turkey Creek pumping stations of the Kansas City water department in operation the daily delivery of water to Turkey Creek has been increased about 10 m.g.d. This makes the maximum daily capacity of the works 85 m.g.d., as the 48-in. steel main and 36-in. cast-iron mains together can carry 75 m.g.d. The new concrete line was put into regular service Jan. 21. Two sections aggregating 1,800 ft. in length are laid in tunnel 15 to 30 ft. below the surface. The remainder of the 7,785 ft. of pipe is laid in open cut. The pipe lengths were made on the job, hauled over soft ground to place on a steel skid by crawler tractors and placed in the tunnels by a special car carrying a cantilever beam. Five tests for water-tightness were made. The conduit is laid from Edgewater Junction to the east line of the water-works property at Quindaro along the south side of the Missouri Pacific right-of-way. At each end the concrete line was connected to 48-in. cast-iron mains on the opposite side of the tracks. A pipe-making plant was established midway of the length of the line adjoining the right-of-way. A stiff-leg derrick with 90-ft. steel boom was utilized for setting and removing forms, setting reinforcing, handling concrete and placing completed pipe in the store yard. A small horizontal boiler was used for operating the machine shop and for supplying steam for curing the pipe. The cast-iron rings forming the bell and spigot, furnished by local foundries, were machined at the pipe plant. The outside of the spigot ring was machined to a true circle, the front end forming a truncated cone. The inside of the bell ring was machined to a perfect circle with a groove machined into it to receive the lead gasket. These rings were set in place with the reinforcing bars. Each pipe was reinforced with ⅜-in. round rods—eight longitudinally and 34 circumferentially. The longitudinal rods were hooked into the bell-and-spigot rings and assembled on mandrels, after which they were set in place by the boom inside of the steel forms. The 1:1½:2½ concrete was mixed on the ground level by two ¼-yd. mixers operated by gasoline engines, and dumped into a chute whence it passed into a ¼-yd. conical bucket handled to the forms by the boom. Each of the 648 pipes was 12 ft. long, had 5-in. walls and weighed 5½ tons when completed.



TYPICAL TUNNEL SECTION, KANSAS CITY CONDUIT

As the conduit is located along the toe of the bluffs adjoining the railroad right-of-way, all of the surface water from the hills flowed to this site and through culverts under the tracks, making it difficult to do any heavy hauling. The pipes were delivered over new roads with a 10-ton crawler tractor. A skid with a steel bottom, 4 ft. wide and 16 ft. long, at the end of which was a wheel 3 ft. wide and 24 in. in diameter, was used in moving the pipes. Loading was done by hand, after which the tractor was hooked to the skid. The tractor operated in the mud about as well as on hard


HAULING 48-IN. CONCRETE PIPE ON STEEL SKID

dry soil. The use of wagons for hauling the pipe would have been almost impossible.

The 5,985 ft. of open ditch excavation was done by contract with the Halpin-Dwyer Construction Co., of Kansas City, under the supervision of Wm. D. Boyle. A trench 7½ ft. wide and from 7 to 12 ft. in depth was excavated by a steam shovel operating on skids over the center of the ditch. The excavated dirt was piled along the south side of the ditch and pulled back into the trench with a backfilling machine after the pipe was laid. It was necessary to brace most of the trench to prevent caving. The shovel excavated about 75 ft. of trench a day, just keeping ahead of the pipe-laying outfit.

Since the bottom of the trench, when excavated, was found to be a wet soggy soil with quicksand in some places, a mat was constructed the entire length consisting of two 4 x 6-in. stringers or sills onto which 3 x 12-in. x 7-ft. plank were spiked. This work was done by separate contract with the excavating contractor who placed the mat just ahead of the pipe layers to prevent any settlement.

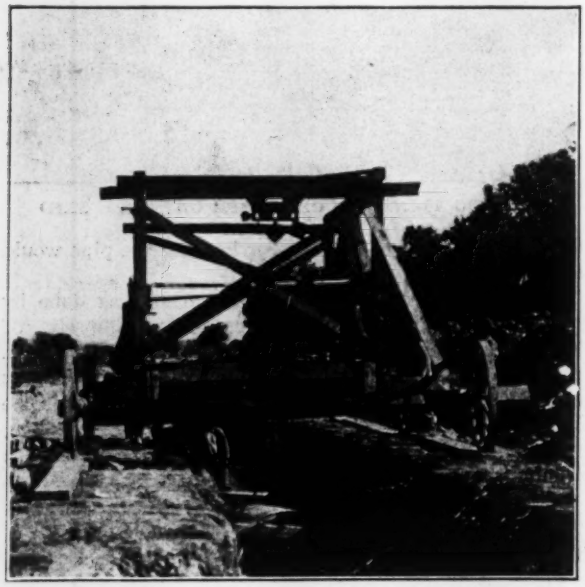
Tunnel Excavation

Two tunnels were driven where the conduit was from 15 to 30 ft. below the surface of the ground. The first tunnel, 800 ft. long on a tangent, was driven from three working shafts 16 ft. long by 8 ft. wide and 400 ft. apart. The second tunnel was 1 000 ft. long and driven on a 1-deg. curve from four working shafts, 333 ft. apart. For lining the tunnels, 3 x 12-in. yellow pine planks 7 ft. long for top, bottom and sides were used. The bottom 3 x 12-in. plank was set in place first, then the top plank was set and held in place with a screw ditch-brace; the side planks were then set, driven to place and cleated at corners with 2 x 4-in. nailing strips. As each lineal foot was excavated, a set of the 3 x 12-in. lining plank was set. The excavated dirt was wheeled to the shafts in wheelbarrows where it was hoisted to the surface with windlasses operated by hand. The inside dimensions of the tunnels when completed were

7 ft. high by 6½ ft. wide. Hand pumps handled the water which came from springs causing headings to cave. Extra bracing then had to be used to support the roof.

This work was done by the water department forces operating in two shifts, from 7 a.m. to 3 p.m. and from 3 p.m. to 11 p.m. It was necessary to employ three 8-hr. working shifts to complete the headings on the two center shafts. A working shift in each heading consisted of nine men: Two to excavate and brace, one to load wheelbarrows, two to wheel out excavated dirt, two on the windlass and two wheelers on top to handle excavated dirt.

The pipes were rolled by hand onto skids over the ditch where they were picked up with a derrick mounted on wagon wheels spanning the ditch and set in place. The joint was made up by placing a lead gasket in



PIPE LAYING GANTRY ON WAGON WHEELS

the machined groove in the bell ring. The spigot end was entered and pulled to place with a clamp fastened to the last pipe laid and to a bar across the end of the pipe being laid. This operation caused a tight pull forcing the spigot end in tight against the lead gasket in the bell ring. The joint was completed by troweling a 1:1 mortar of cement and sand into the joint inside and outside of the pipe.

In the tunnels the pipe was handled with a four-wheel car operated on light rails by a gasoline engine and a niggerhead. A 12 x 12-in. timber 20 ft. long was rigged up on the car making a cantilever boom 8 ft. of which projected ahead of the car, which was 20 ft. long. The pipes were lowered into the tunnels through the working shafts, where they were picked up with the boom. By entering the boom about half way into a pipe length and tightening a chain block on the other end of the boom the pipes were lifted off the floor of the tunnel and suspended on the end of the boom. The back end of the car was loaded with sacks of sand to counterbalance the load and to prevent the car from tilting. A 4-hp. gasoline engine mounted on the car with a niggerhead pulled the car and pipe to place in the tunnel for laying, which was done in about the same manner as in the open trench. The car was pulled back to the shaft again with the niggerhead ready to pick up another pipe, which was lowered after the car was back past the shaft. This method was employed in laying all pipes in the tunnels and was found to be very satisfactory. After the pipes were laid in the tunnels and in the open trench on the mat, concrete was placed under them, extending about 12 in. each side of the center line. This was done to overcome the knife-edge pressure on the bottom and firmly to set the pipes on the mat and give them a uniform bearing.

The tunnels were back-filled with earth after the pipe laying was completed by excavating shafts 50 ft. apart on the center line, 3 ft. square and down through the roof of tunnel. The dirt was placed in the shafts with teams and slips. In the tunnels it was pulled to place by hand.

At the Edgewater crossing the tracks were timbered and the pipes were laid in an open trench about 10 ft. deep. At the Quindaro end a tunnel 75 ft. long was driven under the tracks and filled with concrete after the pipe had been laid. Two 48-in. valves were set on the cast-iron line near the ends of the concrete pipe. Four 24-in. manholes with 3-in. air valves in the top of the plates and two 12-in. drains were placed in the line.

The concrete main was designed to withstand a working head of 100 ft. and a guarantee was submitted by the contractors, the Lock Joint Pipe Co., that the completed pipe line, upon being put in service, would not leak to exceed 0.4 cu.ft. per lineal foot of completed line in 24 hr., which is equivalent to 16.15 gal. per minute for the entire 7,785 feet.

The conduit was filled with water Dec. 24, four days after completion, and allowed to stand for about two weeks when tests for leakage were made at the east end of the line through a 2-in. pipe. A 5-in. double-acting plunger pump, operated by a 4-hp. gasoline engine, was used to raise the pressure on the concrete conduit, the 48-in. valves at the ends of the line being closed. The water going into the conduit was measured with meters which were tested just before being used. The pressure gage used was also tested and corrected. The manhole plate on the highest point on the line, 8.7 ft. above the lowest point on the line, was removed and allowed to remain open during one night to detect any leakage there might be through the valves at the ends of the line; they were found to be tight.

The results of the leakage tests are summarized as follows:

Date, 1921	Pressure, Lb. per Sq.In.	Length of Test, Hr.	Total Leakage Gal. per Min.	Remarks
Jan. 5	36 to 39	3½	51.57	
Jan. 6	37 to 41	3	46.30	About normal pressure
Jan. 7	15	24	14.38	
Jan. 10	30	4	22.73	
Jan. 21	30	6	21.63	After 10 days in service

After the test of Jan. 21 the line was again put in service. Three leaks appeared on the surface over different parts of the line but they have since taken up and stopped. From the present observation on the surface the line is not leaking.

The work was done by the Board of Fire and Water Commissioners of which G. W. Humphry is president. The design and construction was carried out under the general direction of W. B. Goodwin, superintendent, and C. S. Foreman, first assistant engineer. The writer was resident engineer in charge of construction. The Lock Joint Pipe Co. was represented by J. C. Mitchell, general manager, and W. W. Trickey, superintendent.

Computing Reservoir Outflow and Height from Inflow and Capacity

By J. C. Stevens
Of Stevens & Koon, Consulting Engineers, Portland, Oregon.

GIVEN the inflow to a lake or reservoir, the areas of the reservoir and the discharge rating of the reservoir outlet, it is often required to compute the outflow or the rise of the reservoir for a given inflow. The customary method of solving this problem is by a "cut and try" process and is often very tedious.

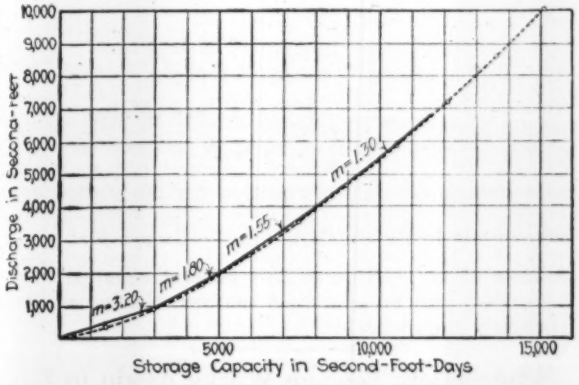
Prof. Pardoe has outlined a solution in *Engineering News-Record*, Jan. 20, 1921, p. 114. A much simpler method is given below:

Let i = rate of inflow into a reservoir;
q = rate of outflow from a reservoir;
s = storage capacity of the reservoir.

In any interval of time dt the quantity flowing into the reservoir is equal to the quantity flowing out plus that stored in the reservoir, hence the fundamental equation

$$i\,dt = q\,dt + ds \qquad (1)$$

The last term of this equation may be positive or negative, according as i is greater or less than q.



RELATION BETWEEN OUTFLOW AND STORAGE CAPACITY

Now the storage capacity of a reservoir and the rate of outflow are both functions of the height or elevation of the water surface, hence it is possible to express the storage capacity in terms of rate of outflow. If therefore we can determine the rate of outflow we can determine the height of the water from the height discharge relation of the outlet.

Thus we may write the equation

$$s = f(q) \qquad (2)$$

whence

$$ds = f'(q)dq \qquad (3)$$

But $f'(q)$ is the slope of the curve in which storage capacity and rate of outflow are plotted as co-ordinates, and may be expressed by a quantity m. Thus (1) becomes

$$i\,dt = q\,dt + m\,dq \qquad (4)$$

Now for many reservoirs m may be practically constant or may in all cases be safely considered as constant between certain limits of q. This is equivalent to substituting a series of chords for the curve $s = f(q)$.

Now consider i as the mean rate of inflow during any finite time interval δt;
also Q as the rate of outflow at the beginning of that time interval;
and q as the rate of outflow at the end of that time interval.

We may then consider the mean rate of outflow during that time interval to be $\frac{q+Q}{2}$ and from (4) we may write

$$i\delta t = \frac{q+Q}{2}\,\delta t + m(q - Q) \qquad (5)$$

Solving for q we have

$$q = \frac{i}{\frac{m}{\delta t} + \frac{1}{2}} + Q\,\frac{\frac{m}{\delta t} - \frac{1}{2}}{\frac{m}{\delta t} + \frac{1}{2}} \qquad (6)$$

As will be shown later, we may drop the $\frac{1}{2}$ added to $\frac{m}{\delta t}$ in the first term of the right-hand number of the above equation without appreciable error, hence (6) becomes

$$q = \frac{i\delta t}{m} + Q\,\frac{\frac{m}{\delta t} - \frac{1}{2}}{\frac{m}{\delta t} + \frac{1}{2}} \qquad (7)$$

By applying formula (7) to successive time intervals, we may very rapidly tabulate the outflow, remembering that the q for one interval becomes the Q for the succeeding one. From the outflow we may readily determine the height of the reservoir at any time.

By way of illustration the solution of Prof. Pardoe's problem by this method will be given, but I would like to digress for a moment and show the advantages of using the second-foot-day as a unit of storage.

The second-foot-day (abbreviated s.f.d.) is the quantity of water yielded by 1 cu.ft. per sec. flowing for 24 hours. It is 86,400 cu.ft. If this quantity falls 1 ft. it represents almost exactly 2 kilowatt-hours of energy. For all practical purposes the second-foot-day is converted into acre-feet by multiplying by 2 (s.f.d. $\times$ 2 = acre-feet) and into mean flow by dividing by the number of days $\left(\frac{\text{s.f.d.}}{n} = \text{mean sec.-ft. for } n \text{ days}\right)$.

In storage calculations, if we express time intervals in days or fractions thereof and storage capacities in second-foot-days we have the inflow, outflow, and storage all expressed in the same units and the calculations are thereby greatly simplified.

Table I gives the storage and discharge relation for Prof. Pardoe's reservoir.

TABLE I

Reservoir Height, Feet, h	Storage Capacity, s.f.d. s	Outflow, Sec.-Ft. q
0	0	0
0.5	1,480	318
1.0	2,970	900
1.5	4,460	1,650
2.0	5,950	2,540
2.5	7,460	3,560
3.0	8,980	4,670
3.5	10,500	5,890
4.0	12,100	7,190

The accompanying curve shows the relation between outflow and storage capacity plotted from Table I and is a graph of $s = f(q)$. The substitution of chords having slopes m for the actual curve is also shown. Prof. Pardoe used 4-hour and 1-hour periods for which $\delta t = \frac{1}{6}$ day and $\frac{1}{24}$ day respectively. Substituting these values in equation (6) we have:

	δt	m	$\frac{m}{\delta t}$	$\frac{\frac{m}{\delta t} - \frac{1}{2}}{\frac{m}{\delta t} + \frac{1}{2}}$
For value of q between				
0 and 1,000	$\frac{1}{6}$	3.20	19.2	0.950

1,000 and 2,000	$\frac{1}{6}$	1.80	10.8	0.911
2,000 and 4,000	$\frac{1}{6}$	1.55	9.3	0.898
	$\frac{1}{4}$	1.55	37.2	0.973
	δt	m	$\frac{m}{\delta t}$	$\frac{m - \frac{1}{2}}{\delta t}$ / $\frac{m + \frac{1}{2}}{\delta t}$
For value of q between	$\frac{1}{6}$	1.30	7.8	0.880
4,000 and 7,000	$\frac{1}{24}$	1.30	31.2	0.969

Table II gives the computations for obtaining the outflow q.

The reservoir height h is obtained from the weir formula.

TABLE II

t Hours	δt Days	i Sec.-Ft.	$\frac{i\delta t}{m}$	$Q\frac{m-\frac{1}{2}}{m+\frac{1}{2}}$	q	m	h
0	0	0	0	....	0	3.20	0
4	$\frac{1}{6}$	2,580	134	0	134	3.20	....
8	$\frac{1}{6}$	2,900	151	127	278	3.20	....
12	$\frac{1}{6}$	3,220	168	264	432	3.20	....
16	$\frac{1}{6}$	3,540	184	410	594	3.20	....
20	$\frac{1}{6}$	3,870	202	564	766	3.20	....
24	$\frac{1}{6}$	4,190	218	727	945	3.20	1.02
28	$\frac{1}{6}$	4,510	416	860	1,276	1.80	....
32	$\frac{1}{6}$	4,840	448	1,162	1,610	1.80	1.48
36	$\frac{1}{6}$	5,490	508	1,465	1,973	1.80	....
40	$\frac{1}{6}$	5,810	625	1,775	2,400	1.55	1.93
44	$\frac{1}{6}$	6,130	660	2,160	2,820	1.55	....
45	$\frac{1}{24}$	8,710	234	2,740	2,974	1.55	2.24
46	$\frac{1}{24}$	22,600	605	2,895	3,500	1.55	2.50
47	$\frac{1}{24}$	32,200	1,030	3,390	4,420	1.30	2.90
48	$\frac{1}{24}$	80,500	2,570	4,280	6,750	1.30	3.84
52	$\frac{1}{6}$	0	0	5,940	5,940	1.30	3.52
56	$\frac{1}{6}$	0	0	5,230	5,230	1.30	3.19
60	$\frac{1}{6}$	0	0	4,600	4,600	1.30	2.97

The maximum rate of outflow was 6,750 sec.-ft. corresponding to a head on the weir of 3.84 ft. Prof. Pardoe gives "about 7,000" with a head of 3.94. The difference is doubtless due to the inability to obtain from the diagram the same rates of inflow and reservoir areas used by him.

Formula (7) may also be obtained by solving the differential equation (4), which is linear if placed in the following form, in which i is some unknown function of time.

$$\frac{dq}{dt} + \frac{1}{m} q = \frac{1}{m} F(t) \qquad (8)$$

The integrating factor for this is $e^{\frac{t}{m}}$ and the solution is

$$q = \frac{e^{\frac{t}{m}}}{m} \int e^{\frac{t}{m}} F(t)\,dt + Ce^{-\frac{t}{m}} \qquad (9)$$

Since we have no mathematical expression for the inflow $F(t)$ the evaluation of the equation and the determination of the constant of integration is mathematically impossible. As close an approximation as may be desired is however possible by considering the integral as the summation of the product of a finite number of values of $i = F(t)$ and finite values of dt. Considered in this light we may say that at the beginning of the time considered or when $t = o$, q has the initial value Q and the integral vanishes since dt is also zero, giving $C = Q$. Considered also as a means of evaluating q for successive time intervals, we may substitute δt for t and consider $F(t)$ as having a single mean value i during the interval δt whence (9) becomes

$$q = \frac{i\delta t}{m} + Qe^{-\frac{t}{m}} \qquad (10)$$

If $e^{-\frac{t}{m}}$ and $\frac{m - \frac{1}{2}}{m + \frac{1}{2}}$ are each expanded into a series they will be found to be identical for the first three terms of the expansion, hence equations (7) or (10) may be used interchangeably, provided $\frac{\delta t}{m}$ is a proper fraction.

The solution of the general differential equation when m is not a constant is, impossible so far as I am aware. Assume that the outflow rating may be expressed by

$$q = ah^n \qquad (11)$$

and that the storage capacity is given by

$$s = bh^r \qquad (12)$$

where h is the height above the point of zero outflow. Eliminating h from these equations we obtain

$$s = b\left(\frac{q}{a}\right)^{\frac{r}{n}} \quad \text{or} \quad s = cq^{\frac{r}{n}} \qquad (13)$$

whence

$$ds = c\frac{r}{n} q^{\frac{r}{n}-1}\,dq \qquad (14)$$

which substituted in (1) gives

$$c\frac{r}{n} q^{\frac{r}{n}-1}\frac{dq}{dt} + q = i \qquad (15)$$

To simplify we may place $q = v^{\frac{n}{r}}$ and obtain

$$\frac{dv}{dt} + \frac{1}{c} v^{\frac{n}{r}} = \frac{i}{c} \qquad (16)$$

as a general differential equation for the outflow from a reservoir in its simplest terms. Except for $\frac{n}{r} = 1$, I know of no solution to this general equation unless $i = F(t)$ can be expressed mathematically, which is obviously impracticable.

Schenectady Sewage Works Again in Use

By John V. Lewis
Superintendent, Bureau of Sewage Disposal
Schenectady, N. Y.

After having been out of operation for eighteen months, the sewage works of Schenectady, N. Y., was again placed in use on Nov. 16. The plant was originally put in service in January, 1915. In the five years which followed there was a slow disintegration of the concrete structures above and at the normal flow line of the sewage. It is believed that the disintegration was caused by frost action. The thin vertical curtain walls, separating the sedimentation chambers and gas vents of the Imhoff tanks, had also proved to be too light to withstand the pressure exerted by the scum and gas confined within the vents and one failure of these walls had resulted. There was also deposition of large quantities of settling solids in the open influent channels of the tanks.

The disintegrated concrete has been torn out and replaced and the curtain walls strengthened. The open influent channels have been superseded by cast-iron conduits placed in the tank proper which will not only overcome the deposition troubles but facilitate the reversing of flow through the tanks as well. The size and shape of the dosing tanks has also been changed to improve the distribution on the trickling filters. As an addition, 25,000 sq.ft. of sludge drying bed area has been provided.

LETTERS TO THE EDITOR

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Temperature Stresses in Concrete Pavement

Sir—In cases where it appears advisable to use a reinforced-concrete pavement from the standpoint of economy or for other reasons it is gratifying to note the growing tendency on the part of the leading highway engineers and designers to reinforce these pavements against temperature stresses and incipient failures caused by these stresses.

I have felt for some time that damage to concrete pavements was primarily caused by the pounding of traffic upon the small cracks resulting from temperature stresses. In spite of our present meager knowledge and data on the location of and amount of maximum stress in a pavement due to static load, impact and varying subgrade conditions, we are at least making a very important forward step in taking care of the stresses due to temperature, awaiting in the meantime for more data on stresses due to other causes.

C. N. CONNER,
Raleigh, N. C., Assistant Engineer, North Carolina
Dec. 2. State Highway Commission.

Roof-Shield Tunneling and Imbedded Rush Rods for Jacking

Sir—The writer, who visited the Flatbush Ave. subway tunnel work on several occasions, feels that Mr. Briggs' paper in your Oct. 27 issue (p. 676) is a notable addition to soft-ground tunneling literature. His illustrations, his descriptions of methods employed and his progress data all will prove useful. The use of "push rods" in wet concrete to take the reaction from the hydraulic jacks is, however, not new as Mr. Briggs intimates. The method was used in the Cambridge subway built by the Boston elevated road several years since. In looking through his files for more data on this Cambridge tunnel, he found in the seventh annual report of the Boston Transit Commission (1901) a description of the work on the East Boston tunnel, where the same method was employed. The sixteenth annual report of this commission also states that the Beacon Hill tunnel work was similarly handled. Both reports are profusely illustrated.

The following memoranda are from the 1901 report of Chief Engineer Carson:

"1892: Roof-shield to run on side walls unsuccessfully tried in Howard St. tunnel in Baltimore.

August, 1895, to October, 1896: Roof-shield running upon a track of wood and steel laid on the ground underlying the arch (not on the tunnel walls) by M. Chagnaud on the Collecteur de Clichy, Paris.

December, 1896, to April, 1897: Roof-shield running on side walls of the tunnel, section 6 of the Boston subway.

1899: Roof-shields running on side walls used on the extension of the Orleans R.R. into Paris. Roof-shields running on track of wood and steel used on the Metropolitan tunnels.

The suggestion of using imbedded metal rods in masonry walls for jacks to push against was made by Walton I. Aims of New York in conversation with the writer in 1892, about four years before it was first made use of on section 6 of the Boston subway."

On section 6 "push rods" were used in the arch of brick masonry. The shield used in the Beacon Hill tunnel weighed 65 tons without jacks, was 32 ft. 6 in. wide, 12 ft. 6 in. long, and had fourteen 8-in. jacks of 80 tons capacity. The normal progress in "a very hard mixture of sandy clay with numerous small stones and boulders" was 40 to 50 ft. per week, as compared with 155 ft. per month on Flatbush Ave.

New York, Nov. 16. JAMES F. FOUHY,
Consulting Engineer.

Data On An Ancient Dam

Sir—Mr. Prelini's article on ancient dams in the issue of Oct. 6 was very interesting and it is to be regretted that he did not discuss the subject at greater length.

There is some disagreement as to the date of construction and dimensions of the Elche dam in Spain. Mr. Prelini states that it was constructed in 913 A.D., while the year 1590 is mentioned in Johnson's Universal Cyclopaedia. If built during the reign of Abderraman III Mr. Prelini is undoubtedly correct. His figures for the height and thickness at base are 52 ft. and 150 ft., respectively. The former agrees closely with the height of 55 ft. given in the Encyclopaedia Britannica but according to Johnson's Cyclopaedia the height is 76 ft. and base 40 ft. These figures of Johnson's as well as those for a number of other dams, agree with Wegmann's profiles. N. B. HUNT.

Denver, Colo., Nov. 4.

Sir—Answering Mr. Hunt's queries, the article "Some Dams of the Ancients" was written for the purpose of detecting the rule followed by the ancients in designing these kind of structures. In it only a few dams were mentioned and among them preference was given to those whereof the dimensions were known.

The apparent disagreement about the dimensions of the Elche dam is easily explained, when we consider that the present dam enclosing the reservoir at Elche is not the original one built by the Moors. The lands in the southern part of Spain were brought to the highest degree of production under the Moorish domination, and such a result was obtained by an elaborate system of irrigation in which the winter waters were stored and used to bath the lands in the dry summer months. According to S. P. Scott, "History of the Moorish Empire in Europe," during the reign of Abderraman III the city of Elche built a reservoir by means of a dam of the dimensions indicated in the article. The slight difference between the dimensions of the Elche dam as given by Scott and the Brittanica, is probably due to the conversion of the Moorish standard measure into the English. The dam built in 913 at the time of the Moorish domination must have collapsed in the course of time, for in order to preserve the fertility of the soil and maintain the irrigation around Elche, another dam was built perhaps in 1590, as stated in Johnson's Encyclopedia, the latter structure of larger dimensions than the old one.

My article mentioned only some peculiar dams built in different countries and by entirely different peoples, but anyone interested in these studies, would find great similarity in many important events recorded in history involving the construction of temporary dams, as for instance the crossing of the Jordan by the Israelites under the guidance of Joshua, and the taking of the city of Mantinea by Agesipolis as described by Xenophon in "Hellenica." Unfortunately the modern engineer is too busy to devote part of his time to the study of what has been done in the past, but time will come when these refinements of our profession will be better appreciated and investigated.

New York, Nov. 10. CHARLES PRELINI.

Double-Slab Concrete Road Successful in California

Sir—I am interested in the article in *Engineering News-Record*, Nov. 17, 1921, p. 804, entitled "New York Develops Double-Slab Concrete Roads."

We have been building the same type of road since 1919. The first one-half mile experimental section met with so much favor that we now have completed a total of 32.7 miles. We make our concrete slab 8 ft. wide and the macadam center 4 ft. wide, but add a 2 ft. macadam shoulder on each side, making the road 24 ft. wide over all. The macadam shoulder os found to be a great protection to the outer edge of the concrete slab and also protects the subgrade from drying out during the dry season.

Most of this type of road has been built on an adobe subgrade. In fact, the idea of designing it was to get a slab which would not crack longitudinally. So far, it has proven satisfactory, not a single crack has shown up since placing the macadam center and shoulder.

The greatest advantage developed so far is increased safety. On our heavily curved sections, no driver has ever

been caught cutting the corners. The driving public is very enthusiastic about the pavement and not only claims it is safer to drive on, but finds it faster with the same degree of safety.

After two years' experience with the 8-ft. slab we do not feel that we would be justified in making it wider, but would prefer using the same money in extra thickness or additional subgrade work. We have been making our concrete slab 5 in. thick, and the oil macadam 5 in. thick, with a crown, so that it is 2 in. higher than the concrete.

Martinez, Cal., Nov. 23. R. R. ARNOLD, County Surveyor.

Public-Utility Motor Vehicles Should Pay More Than Private Cars

Sir—It has been my pleasure to read your painstaking study of "The Trend of Motor-Vehicle Legislation," published in your issue of Sept. 1, p. 354. Again, one is struck by the fact that our division into 48 detail sovereignties and one blanket sovereignty is a great hindrance to the settlement of problems that have no real relation to political subdivisions.

Yet despite the great variety and diversity of the practices listed, no wide recognition seems to have been given to the difference between the privately used motor vehicle and the public-utility motor vehicle. The difference can be very great. A private automobile mounted on pneumatic tires may use the public highway to the extent of but 5,000 to 10,000 miles per annum; a public motor-bus mounted on solid tires, but carrying an engine of the same horse-power rating, may be running over the same highway to the extent of 30,000 to 40,000 miles a year. It would clearly be unjust to treat both vehicles alike from the tax-gatherer's standpoint.

Great Britain's experience with public-utility motor vehicles goes back farther than our own, so that possibly our legislators may gain something of value from her. Until the passage of the Roads Act of 1920, the principal tax was one of 12c. per Imperial gallon (277¼ cu.in.) of gasoline to those who bought less than 500 gal. a year, and half that amount of those who bought more. Practically, then, the public-utility operator as a wholesale user was being favored over the people who imposed less wear and tear on the roads! This tax in its earlier form (1910) had been imposed "for the improvement, construction and maintenance of roads in the United Kingdom, and to render financial assistance to the County Councils," but by 1915 war conditions led to the end of this pleasing arrangement. During the following years, the county councils made their own rules as to how much local public utilities should pay toward road upkeep regardless of their national gasoline tax and nominal license fees. These roadway upkeep charges varied from 1 to 8c. per vehicle-mile, and their fluctuations from year to year and county to county were a source of severe irritation to the operators of public-utility vehicles such as motor-buses and *char-a-bancs*.

In the legislation known as the Roads Act of 1920, we see the advantage of dealing with one government instead of 49. The taxing powers of the county councils have been abolished because the new taxes are intended to cover every proper assessment against motor vehicle operation. The funds from this taxation go to the Ministry of Transport which, in turn, may assist the several councils in road maintenance. Thus, Sir Henry Maybury, director-general of the Ministry of Transport told the Devonshire County Council on Sept. 17, 1920, that it was the intention of the government to subsidize first-class roads (say 20 ft. wide) to the extent of 50 per cent and second-class roads to the extent of 25 per cent. In any case, the writer has observed that subsidies are being granted from time to time, even to the extent of helping to pay for individual machines like a road roller.

Now with regard to the details of the taxes which became effective Jan. 1, 1921: A clear distinction is made between public-utility vehicles and private vehicles; and there is also a distinction between the use of the former in the London metropolitan area and outside of it. Otherwise, all rates are uniform throughout the United Kingdom. The lowest tax, 15 shillings ($3 at present exchange of $4 to the pound), is charged against street cars, inasmuch as street railways make heavy payments for paving under long existing franchise obligations. We then come to motor-buses and *char-a-bancs* which are rated as follows:

	In London Area	Elsewhere
Not more than 6 seats	£ 15	£ 12
Not more to n 14 seats	£ 30	£ 24
Not more than 20 seats	£ 45	£ 36
Not more than 26 seats	£ 60	£ 48
Not more than 32 seats	£ 72	£ 60
More than 32 seats	£ 8.	£ 70

With regard to the foregoing, it is a truism that no sooner is a law passed than its weaknesses begin to come out. This summer the writer ran across a British operator who had deliberately removed two seats from his 26-seat buses in order to save £12 a year tax. It will also be seen that the tax does not contemplate buses seating much more than 32. When the Act was passed, most buses in London were 34-seaters; now the standard is 46 seats with plenty of 51-seaters under way. The London General Omnibus Co. averaged £63 annual total taxes under the old rules for every bus in stock or £79 for the average number of buses in operation. The new tax of £84 is per bus in stock, but there has been no real increase in taxation per seat.

Without going into detail, it may be pointed out that private cars are taxed on a horse-power basis, £6 if not exceeding 6 hp. and £1 for each additional horse-power or fraction thereof. Motor-trucks are taxed on an unladen weight basis from £10 for vehicles of 1.2 long tons to £30 for trucks of 4 long tons plus £2 for a trailer. The low-speed road locomotives so popular in England are charged £25 up to 8 tons, £28 up to 12 tons and £30 if over 12 tons. Tractors cost from £6 to £21, but plowing engines, etc., for farm use pay the nominal charge of only 5 shillings. Cycles range from £1/10 for weights of less than 200 lb. to £4 for motor-cycles with side car.

This is the situation to-day, but there are strong automotive interests agitating for a tax based primarily upon fuel consumption. This idea is opposed, for obvious reasons, by public-utility operators.

New York City, Nov. 19. WALTER JACKSON, Motor Bus Consultant.

Motor Fees Yield $108,213,165 in 6 Months

A total of 9,245,195 passenger automobiles, trucks, and commercial vehicles, 28,114 trailers, and 177,234 motor cycles were registered in the 48 states and the District of Columbia during the first six months of the present year, according to the U. S. Bureau of Public Roads. As a result of these registrations and the licensing of drivers, the states and district collected, during that period, a total gross revenue of $108,213,165. The figures show an increase of nearly $6,000,000 over the full year of 1920, when such revenues totaled $102,546,212. "Of the 1920 registration revenues," says the bureau, "$97,671,742, or 95 per cent, was available for road work. Of the registration revenues collected during the first six months of the current year $101,793,416 is available for road work, either by the state highway departments or local road officials" is 94 per cent—an apparent decrease of 1 per cent, but the increase seems more apparent than real, because in some states the funds do not become available until the end of the year. Ten state legislatures have imposed a tax on gasoline during the current year. They are Arkansas, Arizona, Connecticut, Florida, Georgia, Montana, North Carolina, Pennsylvania, South Dakota, and Washington. Prior to this year Colorado, Kentucky, New Mexico, and Oregon had levied such a tax.

HINTS FOR THE CONTRACTOR

Pile Holes Blasted for Ocean Pier

BY H. H. BRAUN
Engineer Constructor, Manila, P. I.

PRECAST concrete piles set in holes drilled 13 to 15 ft. deep in a hard bottom were employed in building a reinforced-concrete pier at Manila, P. I. The bottom, ranging in depth from 10 to 26 ft., is a volcanic formation, intermediate between soft rock and very hard hardpan, with no overburden. It was utterly impossible to drive a pile directly in any manner.

The first effort to meet the conditions failed. A 12-in. iron pipe was rigged in the leads of the pile driver, lowered to the bottom, and a heavy 11½-in. well drill bit, operated by the pile-driver engine, put to work. Two holes were completed, but it was impossible to drive an 18-in. pile into a 12-in. hole.

The next method proved very successful. A frame and scaffold was built out over the end of a flat scow, supporting three 3-in. pipes, spaced to agree with the three piles in the bent. Two piles only were used in the stem of the pier. After the scow was properly lined and centered, the pipes were lowered to the bottom, an expansion bit, Fig. 1, inserted and a 3½-in. hole drilled about 18 in. into the rock, into which the pipe was lowered. This served to center and hold the 3-in. pipe casing for subsequent drilling and blasting.

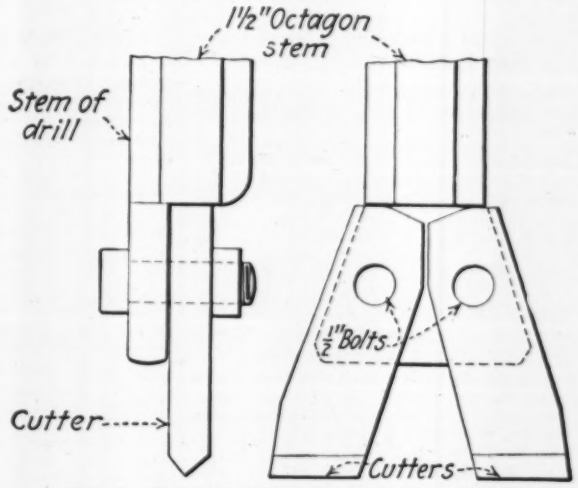


FIG. 1. EXPANSION BIT FOR CHURN DRILLS

Holes were then drilled down through the pipes. Three bits were used, each 4 ft. long, and 2½ in., 2¼ in. and 2 in. in diameter respectively, made to screw onto the end of a long 1½-in. common pipe handle.

Progress was slow and the work difficult, partly because the swells made it hard to center and hold the scow in place. It required usually 12 hours to drill and blast a set of holes to a depth of 10 to 13 ft.

During typhoons, the pier is subject to violent wave action. The water is 23 ft. deep at low tide, the deck is 12 ft. higher, and as the piles driven into the blasted rock seemed to be deficient in lateral stability, it was deemed necessary to incorporate a thorough system of bracing. As it was not practicable to drive batter piles for this purpose; each pile was braced each way by reinforced-concrete horizontal struts at low water, and diagonal sway braces from these struts to the deck beams, Fig. 2. In the stem of the pier every second pair of bents only was thus braced.

To connect the bracing system to the precast piles, the pile was first roughened, and a wide piece of wire mesh wrapped around it. Then a heavy clamp, made of ¼ x 4-in. flat iron was bolted around the pile, and over the mesh. The brace reinforcement was then hooked around and through the clamp bolts, the wire mesh bent over the clamp, and the joint braces concreted at the same time as the deck.

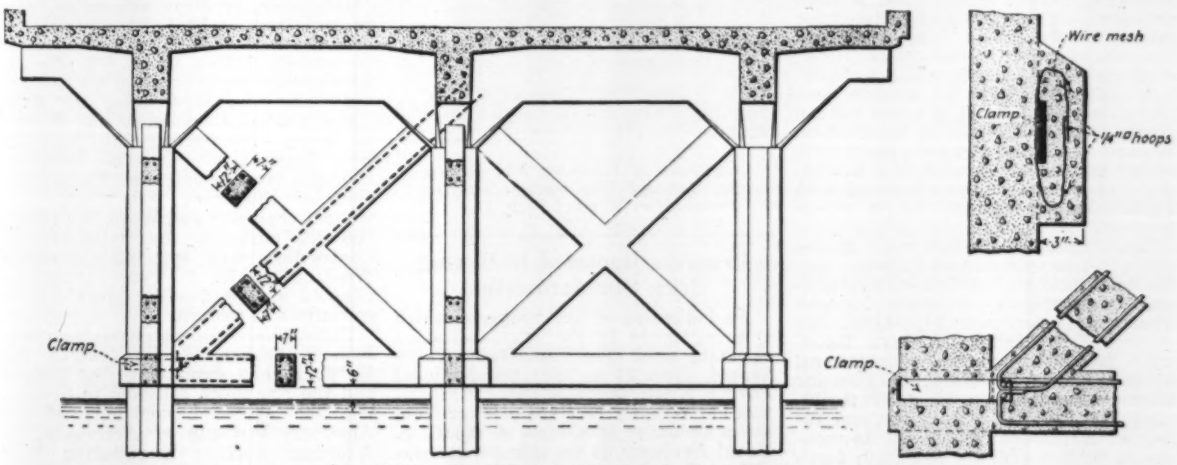


FIG. 2. PILE BRACING AND CONNECTIONS

This design, with bracing below the deck and down to low water, would present elements of danger in any location subject to wave action, if ice or debris were liable to accumulate. While there are terrific waves at the site, there is almost no debris, and there is of course no ice problem. Reinforced concrete in tropical seas is particularly liable to failure if all steel is not deeply embedded in the concrete. Extreme care was exercised in constructing the brace joints, to obtain a sufficient cover of rich, impervious concrete.

NEWS OF THE WEEK

New York, December 22, 1921

Federal Budget Provides for Engineering Work

Details of $73,000,000 Appropriation Announced in Last Week's Issue

For the current fiscal year $9,000,000 has been made available for canal work, whereas only $4,241,174 is asked for that work during the next fiscal year. The reduction in the Interior Department estimate is due largely to the decrease in the amount requested for reclamation work. The amount appropriated for the current year was unusually large, due to the accumulation of funds under the oil-land leasing act.

DETAILS OF APPROPRIATIONS

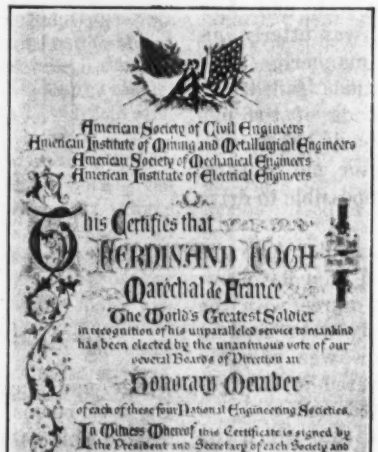
For public works under the Treasury Department, which includes construction, extensions and repairs to customs houses, postoffices, hospitals, quarantine stations, and other public buildings, $5,471,800 is asked. The appropriation for the current fiscal year was $2,560,631 for public works in the Treasury Department. The estimates call for $48,457,722 for public works coming under the jurisdiction of the War Department. The appropriations for this item for the current fiscal year aggregate $34,775,578. The amount requested for public works under the Navy Department is $5,134,000, as compared with $4,837,000 appropriated for the current fiscal year. The total asked for the Interior Department public works is $8,414,750, whereas $21,113,000 was appropriated for the current year. The sum of $1,283,500 is asked for the construction and repair of lighthouses, beacons and fog-signals, which are under the jurisdiction of the Department of Commerce, as compared with $1,006,500, the current year's appropriation.

The larger items which make up the public works total are as follows: For the construction of a three-story building to provide vault space for the Treasury Department $1,000,000; for the site of the National Archives Building, $500,000; quarantine stations, $77,000; marine hospitals, $351,000; for extension and repair of public buildings, $931,500; for installation and repair of mechanical equipment in completed public buildings, $855,000; fortifications and other works of defense, $7,000,000; for repairs and improvements at arsenals and depots, $805,000; for the construction and enlargement of military posts in the Hawaiian Islands, $1,059,490; for constructon and enlargement of buldings at military posts $916,000; Gatun storage plant, $1,028,800; Fort Clayton, C. Z. barracks and quarters, $1,567,600; buildings and grounds in and around Washington, $752,126.

Other items are: Rivers and harbors (including continuing contract work), $34,955,260; repairs Capitol building, $153,500; bridge Navy Yard, Portsmouth, N. H., $250,000; dredging and pile caps, Philadelphia Navy Yard, $200 000; wharves and quay-walls and dredging, Mare Island Navy Yard, $350,000; pier No. 4 rifle range, central power plant Puget Sound Navy Yard, $700,000; addition to machine shop, warehouses, water supply, Pearl Harbor Naval Station, $681,000; submarine base, Guam Naval Station, $200,000; ordinance storage and water front improvements Cavite Naval Station, $163,000; shore protection and harbor improvement, Great Lakes Training Station, $425,000; marine corps base, San Diego, $500,000; naval hospital, San Diego, $500,000; submarine base, San Pedro, Cal., $100,000; destroyer base, San Diego, $200,000.

Hold Bonds for Premium Bid

An offer of par value and accrued interest for the $1,250,000 issue of street improvement bonds voted in September, has been refused by the city of Dallas, Texas. The bonds are expected to bring a premium.


American Society of Civil Engineers
American Institute of Mining and Metallurgical Engineers
American Society of Mechanical Engineers
American Institute of Electrical Engineers
This Certifies that
FERDINAND FOCH
Maréchal de France
The World's Greatest Soldier
in recognition of his unparalleled service to mankind
has been elected by the unanimous vote of our
several Boards of Direction an
Honorary Member
of each of these four National Engineering Societies
In Witness Whereof this Certificate is signed by
the President and Secretary of each Society and
delivered in the City of New York the thirteenth day
of December nineteen hundred and twenty-one

Certificate of Honorary Membership in National Engineering Societies Presented to Marshal Foch, Dec. 13

Progress Reported in Paving Brick Standardization

As indicative of the progress which is being made in the standardization of paving brick (See *Engineering News-Record*, Nov. 24 p. 869) the National Paving Brick Manufacturers Association has recently received a letter from the commander in charge of the U. S. Naval Academy, to the effect that compliance had been made with the new specifications. The U. S. Naval Academy requisitions for repressed paving brick have been changed from the 3-in. to the 3½-in. depth, in accordance with the new specifications.

Katy Road Plans Betterments

The Missouri Kansas & Texas R.R. plans to replace its 66-lb. rails with 85-lb. rails between Gainesville and Wichita Falls, Texas. The new track-laying program will be a $1,000,000 project according to W. M. Whittenton, chief operating officer. Work on the widening of the tracks will be begun after Jan. 1 and will be finished by the middle of the year.

Completion of a general inspection of the Katy Line has been completed by E. C. Henderson of New York, general counsel for the reorganization committee to perfect plans for the dissolution of the Katy receivership. The physical condition of the lines in Texas was found to be excellent.

Conference on Uniform Contracts Makes Progress

Inspired by the announcement of Secretary Herbert Hoover, who opened the sessions, that its determinations would have the influence and backing of the Department of Commerce, the conference on uniform construction contracts held Dec. 15 and 16, in Washington, D. C., made progress in organizing for the task before it.

Delegates, or their alternates, were present from each of the nine national organizations listed in *Engineering News-Record*, Nov. 24, p. 873. To this membership the committee added R. C. Marshall, Jr., representing the Associated General Contractors and William B. King, representing the American Bar Association. Onward Bates of Chicago, representing the Western Society of Engineers, was elected permanent chairman and Ward P. Christie, research engineer, Associated General Contractors, was appointed secretary. Washington, D. C., was tentatively adopted as the meeting place for the committee in session.

Statements were received from William S. Parker, W. D. Faucette and H. K. Bishop explaining the purpose and the procedure followed in developing the standard contracts of the American Institute of Architects, the American Railway Engineering Association and the U. S. Bureau of Public Roads. A standard form of agreement for all constructon and schedules of general conditions for highway construction, building construction and railway construction, which had been drafted by the Associated General Contractors, were then read and accepted as a basis for discussion. The procedure, it was agreed, should be to consider first the standard agreement, section by section, to adopt or reject each section, and redraft the adopted sections as general principles governing all contracts. With this task completed the committee, it was considered, would be co-ordinated with the task before it so that it could determine a plan of procedure which could be placed before the various organizations with requests for authority to proceed.

Florida County to Sell Road Bonds

The first part of the Orange County (Florida) $2,250,000 road bond issue is to go on the market soon. Funds received from the sale of the bonds will build, according to present plans, a 15-mile stretch to be known as the Mount Dora and Plymouth Highway. It is possible that the Major Charles A. Brown, state highway engineer, will take charge of the county program which includes the construction of close to 50 miles of road.

Hydraulic Plant for Diamond Mining in Arkansas

Part of the large amount of equipment that is being purchased and installed for the operation of diamond mines in Pike County, Ark., will be a hydraulic plant, as extraction of diamonds there is susceptible of that method. At present only experimental work has been done, but a company capitalized at $10,000,000 has been formed and several large gems have been mined.

New Jersey Commuters Organize for Rapid Transit to New York

A New Jersey Metropolitan Rapid Transit Committee of 15 to take steps to secure facilities for landing passengers in New York City near their places of business is to be appointed as a result of a Bi-State Rapid Transit Conference of representatives of the five New Jersey counties of northeastern New Jersey held at Paterson, N. J., Dec. 15, under the auspices of the City Plan Commission of Paterson. The committee will be appointed by B. H. Saunders, chairman of the commission and of the conference.

The discussion at the conference was centered on an address by Herbert S. Swann, city planner, New York City, epitomizing a longer address on "A Bi-State Rapid Transit Plan" recently made to the Paterson City Plan Commission and now available in printed form. In brief, Mr. Swann advocates "bringing the Jersey railroads into Manhattan and linking them with New York Central, New Haven and Long Island lines in a manner to provide faster travel for the whole metropolitan area." Mr. Swann also urges the need for better north and south transit facilities in the New Jersey metropolitan district so as to obviate the present necessity of travelling to the Jersey shore of the Hudson on one radial line and back again on another —to get from Paterson to Plainfield, for instance.

Besides addresses by residents of the proposed New Jersey Metropolitan Rapid Transit District, Daniel L. Turner, consulting engineer, New York Transit Construction Commission, spoke on "The New Jersey Commuter in the Subways" and remarks were made by representatives of several railways. A letter was sent by Samuel Rea, president of the Pennsylvania Railroad, in which he stated Mr. Swann's suggestion for the use of the Pennsylvania tunnels and terminals by still other railways is barred by the fact that the capacity of these facilities has been reached, so it is only a question before the Baltimore & Ohio and Lehigh can no longer be accommodated.

Hoist Runners—Not Engineers

At a recent meeting of the New York Assembly, American Association of Engineers, held in Albany, N. Y., the following resolution was unanimously adopted:

"It is the sense of this meeting that engineers, when drawing up contracts, supplementary agreements for extra work, and at all other times, should discontinue the designation as engineer, of hoist runners, engine drivers, and all others engaged in allied trades and employment."

To Call for Bids on Hudson Vehicle Tunnel

With the signing of the long delayed contract with the Erie Railroad, involving property rights in Jersey City in the vicinity of the proposed tunnel entrance and ventilating shafts, the chief obstacle in the way of starting work on the vehicular tunnels under the Hudson River from New York City, has been removed and present plans of the New York and New Jersey Tunnel Commissions contemplate issuing a call for bids on or about Dec. 27.

C. M. Holland, chief engineer, has announced the completion of the New York ventilating shafts by the firm of Holbrook, Cabot & Rollins, the contractor. The work has proceeded without a hitch and the final estimate of $643,195 was approved Dec. 14.

Wisconsin Plans Road School for State Employees

The Wisconsin Highway Commission's Road School will be held in Madison commencing, Jan. 23, 1922, and continue in session throughout that week. All of the engineers in the employ of the state department and county road officials will be in attendance. The registration in 1921 was over 900.

The exhibiting of road machinery is encouraged by the commission, especially that machinery which is designed to meet up-to-the minute needs in road construction.

Florida Road Bonds Unsalable Within Legal Limits

Close to $5,000,000 worth of public improvements are being held up in Florida, pending the ability of trustees to secure the minimum the law permits to accept for Florida bonds—95c. The Lake County $600,000, 6 per cent issue is the latest example, bids of less than 90c. having been recently rejected and the issue ordered readvertised.

The Escambia County $1,000,000 road bond issue, now two years old, is still awaiting a legal bid, as is Pasco County's $750,000 issue, which is as old. Marion County and Alachua each have arranged for issues of $500,000. Palm Beach County has had trouble in disposing of its issue of $400,000 and Monroe County bonds likewise await a call. Miami just rebonded for $400,000 having been unable to sell a $400,000 issue prior to a recent change in the form of government, which made necessary revoting the issue.

Pennsylvania Contractors Hold Road Conference

In Meeting With Material and Equipment Men at Harrisburg They Discuss Means of Reducing Costs

Lower road-building costs and strict adherence to its slogan of "Skill, Integrity, and Responsibility" formed the keynote of the Highway Construction Conference held in Harrisburg, Pa., Dec. 16, in conjunction with the second annual meeting of the Associated Pennsylvania Highway Contractors, the local organization of the Associated General Contractors of America. The morning and afternoon sessions were given over to discussion of road-building problems from the point of view of banker, surety company, material and equipment manufacturer and the state highway department, in order that closer co-operation might be secured among all interests concerned in the building of highways. H. H. Wilson, president of the Pennsylvania contractors' organization, and resident managing partner for Winston & Co., presided, and acted as toastmaster at the banquet which concluded the meeting in the evening.

The need for frankness on the part of the contractor in his dealings with the banker was emphasized by E. J. Stackpole, director of the First National Bank of Harrisburg. "Tell the banker," he said, "the whole story of your financial condition when you are seeking a loan." The banker, according to Mr. Stackpole, stands ready to co-operate with the contractor in meeting all reasonable demands for cash. The contractor must remember, he said, that a bank needs liquid assets, and loans should not be requested for too long a period, for the bank's main function, in his opinion, is to help the contractor over the peaks of his financial troubles.

Bonding Costs

A lively discussion was precipitated by the address on methods employed by surety companies in underwriting risks by E. C. Lunt, vice-president, Fidelity & Casualty Co., New York. The main points that interest the surety company are (1) the contractor's financial condition as determined from Dun and Bradstreet, from local bankers, and from the contractor's own financial statement; (2) the contractor's record on past work and the amount and conditions of his plant; (3) a comparison of his bid with the bids of other responsible contractors on the same job; and (4) the amount of work which a contractor already has on hand. The present rate charged by surety companies on state highway contracts, 1½ per cent, was regarded by several contractors as too high. The point was brought out that a lower rate should be given to an old-established, responsible bidder than to a newcomer in the contracting business. As matters now stand, however, a uniform rate of 1½ per cent is charged to all parties. The discussion ended in the passage of a resolution calling upon surety companies to lower their present rates and to exercise more care in the assumption of risks.

Speaking for the cement producers, William McIntyre, of the Atlas company, predicted for 1922 a substantial increase in the use of cement both on highway work and building construction. There will, however, be no cement

shortage next year. He urged contractors to arrange for deliveries well ahead of the actual need for them in order that mill production and shipments may be co-ordinated. Contractors can help the industry, he said, by exercising greater care in the handling of cement bags. Ernest Ashton, of the Lehigh Portland Cement Co., made a plea for the use of coarse aggregate of softer quality than is now generally specified for highway work. A resolution was passed indicating that the cost of highway construction could be lowered, without affecting the quality of roads, by changing state highway specifications so as to provide for other than extremely hard grades of coarse aggregate.

Speaking for the General Crushed Stone Co., Herbert Allen objected to the present high freight rates on crushed stone, a view in which he was supported by J. E. Carroll of the J. E. Carroll Sand & Gravel Co. The conference passed a resolution urging the reduction of freight rates on sand and stone.

For the asphalt producers, William King, of The Texas Co., and Louis Young, of the Atlantic Refining Co., reported satisfactory conditions during the year.

The morning session of the conference was concluded by the passage of a resolution offered by President H. H. Wilson stating that road-building costs could be reduced by the adoption of a form of contract between contractor and material or equipment manufacturer which would be more binding on both parties.

EQUIPMENT PROBLEMS

The policy of "Let the buyer beware" finds no place in present methods of selling construction equipment, according to Mr. Goodling, of the Galion Iron Works & Manufacturing Co. George Sherron, of the Koehring Machine Co., urged a closer relationship between contractor and manufacturer, and made a plea for simpler specifications for equipment and materials. In the field of paving mixers, he said, the trend is away from the steam operated plant and toward the gasoline-engine-driven unit. Robert M. Gates, of the Lakewood Engineering Co., in speaking of the mechanical handling of road material, pointed out the need for closer supervision of operations and the employment of more competent mechanics by contractors. For the Blaw-Knox Co., Edward N. Ornitz favored greater standardization of construction equipment, citing as a precedent the recent action of the brick manufacturers in reducing the variety of their products. The discussion on plant equipment ended by the passage of a resolution urging a greater degree of standardization and suggesting conferences between representatives of the Associated General Contractors and the equipment manufacturers.

Representing the Pennsylvania State Highway Department, Howard W. Fry commended the policy of personal interviews with contractors before awarding work in order to determine their construction experience and financial ability. A large letting of Pennsylvania work is scheduled for February, including one 25-mile length of road divided into three sections.

Suggestions as to the outstanding features of the road-building problem upon which a fuller public understanding is needed were offered in an address by R. K. Tomlin, Jr., associate editor, *Engineering News-Record*. In discussing this subject William Jabine, of *Successful Methods* concurred in the opinion that publicity for road work in the future should come from the road-builder rather than the road "booster."

The speakers at the banquet included Charles F. Puff, Jr., secretary and general manager of the Associated Pennsylvania Highway Contractors, Lt.-Gov. J. E. E. Beidleman, Daniel A. Garber, director of the Associated General Contractors, W. D. Hill, president-elect of the Pennsylvania organization, and Henry H. Wilson, the retiring president, who acted as toastmaster. Mr. Beidleman denied rumors that the year 1922 would see a curtailment of state highway activities in Pennsylvania. The state, he said, intends to proceed with its program and will be a leader among the states in permanent road construction.

Mr. Garber mentioned high freight rates as one of the contractor's most serious problems. He referred to the Lockwood Committee's investigations of the building industry in New York, emphasizing the point that in the list of indictments of equipment and material men the name of not a single contractor was to be found. A committee of the Associated General Contractors is now at work with representatives of the Department of Commerce to secure standard forms of contract and eliminate waste.

The Associated Pennsylvania Highway Contractors has shown a 115-per cent increase in membership during the year and now has on its rolls 90 members. The new officers elected are: President, William D. Hill, Samuel Gamble Co., Pittsburgh; first vice-president, Samuel M. Irwin, Union Paving Co., Philadelphia; treasurer, Lea Hunt, Hand-Hunt Co., Wilkes-Barre. The directors have reappointed Charles F. Puff, Jr., as secretary and general manager; it was through his efforts that the conference was arranged.

Texas City to Extend Water and Sewer Facilities

The city council of Graham, Texas, has let a contract for the extension of the water and sewer mains to cover: An additional pump to be installed at the pumping station; a 300,000-gal. reinforced-concrete standpipe; a new sewage disposal plant; and a 10-in. water main from the pumping station to the standpipe.

Ask Twenty-Seven Millions for Rivers and Harbors

The annual estimates of expenditures submitted to Congress Dec. 5 by the President and the Director of the Budget request appropriations totalling $27,885,260 for river and harbor work during the next fiscal year. This is exclusive of the continuing contract work, for which an additional $7,070,000 is asked. Of this latter amount, $6,670,000 is intended for flood-control work on the Mississippi and $400,000 for flood control work on the Sacramento river. During the current fiscal year, $15,250,000 was appropriated for the regular river and harbor work and $7,170,000 for the flood-contr work.

General Contractors Announce Convention Program

Two sessions daily and one evening session will be devoted to association business or technical discussion at the three-days' convention of the Associated General Contractors of America to be held Jan. 17-19, 1922, at Cleveland, Ohio. Speakers of national prominence will feature the opening session. Reports of standing committees of the association will be received and discussed at the second session.

On the second day building contractors, highway contractors, railroad contractors and public works contractors will hold separate meetings, morning and afternoon, and in the evening there will be a general session at which the chairmen of the sectional meetings will present summaries of the day's work for discussion and the action of the full convention.

With the exception of an address on the cost of financing construction, the final sessions will be devoted mostly to the transaction of association business.

N. Y. Port Authority Makes Report on Plan

At a conference Dec. 7 of the so-called advisory council, made up of representatives of the various interests in the Port of New York, E. H. Outerbridge, chairman, Port of New York Authority, submitted what he called a preliminary report of a comprehensive plan for the development of the Port of New York. The act creating the Port Authority requires that body to submit to the two legislatures before Jan. 1, 1922, a so-called comprehensive plan of the development of the port. Such a plan had been worked out and reported by the bi-state port and harbor commission, which preceded the Port Authority. The latter body was under no obligation to report the same plan as its predecessor, although a large part of the personnel of the two bodies is the same and their technical staffs identical.

The scheme presented in the conference varies little from the comprehensive plan of the commission. It re-emphasizes the fact that the problem of the port is a railway terminal problem and to the solution of that problem it offers a number of belt lines divided into the inner or water-front group, the middle group, and the outer group. It reiterates the fact that the west water front of Manhattan Island must be cleared of terminals and made free for ocean shipping, that the opposite or Jersey shore should be developed for pierhead rail lines, and that the terminal break-up stations must be back of the Palisades on the Jersey shore and back from the Hudson water front on Manhattan Island, with the connecting tunnel and the automatic-electric railway emphasized in the earlier report. However, the current scheme places the necessity for the automatic-electric railway somewhat further off than did the earlier scheme and concentrates more attention on the development of the ferries for motor-truck transportation to inland union terminals.

Bureau of Standards Asks $175,000 for Structural Study

For the continuation of its investigation of structural materials the Bureau of Standards has requested Congress to vote it $175,000 to apply on its work during the next fiscal year. A similar amount was appropriated for this year's work. Of the amount $50,000 is to be devoted exclusively to the collection of information tending to show approved methods in building, planning, construction, standardization and adaptability of structural units.

For the continuation of the investigation of fire-resisting properties of building materials, an appropriation of $25,000, the amount allowed for this year, is asked. This investigation includes a study of the conditions under which fire-resisting materials may be used most efficiently. Information concerning foreign progress in this particular also is to be undertaken.

For a study of methods of measurement and the technical processes used in the manufacture of clay products, a continuation of the annual appropriation of $25,000 is asked.

Santa Fe Plans Industrial Extensions in Dallas

The Santa Fe R.R. is planning to make extensive additions and improvements in Dallas as a result of an inspection completed recently by the assistant general manager and other Santa Fe officials. Freight facilities have become inadequate and the Santa Fe officials have felt for some time the need of additional facilities for industrial uses along its terminal tracks.

New Truck Ruling in Connecticut Involves Rated Capacity

As a result of a joint ruling made Nov. 4 by Charles J. Bennett, state highway commissioner of Connecticut and Robbins B. Stoeckel, commissioner of motor vehicles any person desiring to register a commercial motor vehicle for an increase over its rated capacity must secure from the engineering department of the company manufacturing such motor vehicle a certificate to the effect that such vehicle or type of vehicle is capable of being safely operated under all conditions at all times when loaded to the increased capacity applied for.

It is possible, says a recent bulletin of the National Automobile Chamber of Commerce, that the granting of such a certificate would constitute a warranty against possible mechanical failures in the motor vehicles resulting from the overloading authorized. Moreover, in case of accident arising from the operation of such an overloaded vehicle, the manufacturer issuing such a certificate might be liable for any injury to persons or damage to property. Truck manufacturers, it is pointed out, should further realize that by issuing such certificates they place themselves in the position of sponsoring or even fostering the overloading evil which the Truck Committee of the Chamber has been steadfastly opposing.

The new ruling does not change the highway department's policy of limiting gross loads to 25,000 lb. and loads per inch width of tire to 800 lb.

Henry Turner Eddy

With the death of Prof. Henry T. Eddy last week one of the notable figures of an earlier generation in American engineering passed from the stage. For more than forty years Dr. Eddy taught engineering, retiring in 1912. During the past ten years he has been at work on various problems of the mechanics of reinforced concrete, in cooperation with C. A. P. Turner, of Minneapolis. Mr. Turner writes of Dr. Eddy thus:

"With exceptional mathematical knowledge and high scientific attainment he combined the fine characteristics of simplicity, courtly manners and gentleness which caused him to be honored, loved and respected by all who came in contact with him.

"He was born at Stoughton, Mass., on June 9, 1844. His early aptitude for mathematics was shown at Yale, where he received first prize in every competition and was awarded the senior gold medal on his graduation in 1864. He received the degree of Ph.D. there in 1868.

"From 1869 to 1873 he was assistant professor of mathematics and engineering at Cornell, where he received the degree of Civil Engineer, in 1870, and later the first degree of Ph.D. conferred by that university. He was adjunct professor of mathematics at Princeton in 1873, but in 1874 upon the organization of the new university at Cincinnati he was elected to the chair of mathematics, astronomy and civil engineering, remaining in this position until 1890. During this period, in 1879-1880, he was on leave of absence and studied mathematical physics at the University of Berlin and at the Sorbonne and the College de France, Paris.

"In 1890 he accepted the presidency of the Rose Polytechnic Institute at Terre Haute. He came to the University of Minnesota in 1894 as professor of engineering and mathematics in 1906 he was made dean of the graduate school of that institution; and in 1912 he retired, with the title professor of mechanics and Dean Emeritus. During the last fourteen years of his life, almost to the time of his death, he engaged more or less in research work in the field of reinforced concrete.

"Dr. Eddy was the author of many short treatises. Among them are 'Analytical Geometry' (1874), 'Researches in Graphical Statics' (1878), 'Thermodynamics' (1879), 'Neue Constructionen aus der Graphishen Statik' (1880), 'Maximum Stresses Under Concentrated Loads' (1890), 'Theory of Reinforced-Concrete Floor Slabs' (1913), and with the undersigned as co-author, 'Concrete Steel Construction' (1914, 1919).

"His treatises on 'Graphical Statics' (1878) deserves to be singled out from this list as a work of pioneer character rendering more advanced theoretical achievement practicable, and also a work which might well be adopted today in all schools of engineering.

"As the writer worked with Dr. Eddy for the past fifteen years, he may be permitted to recall that we first met in the laboratory of the University of Minnesota, where the writer was testing a steel girder to determine the relative stress distribution through the stiffeners and web plates. The acquaintance commenced with a friendly theoretical controversy upon various matters of structural mechanics which in effect continued without interruption up to the time of the illness of Mrs. Eddy. An earnest searcher for the truth, Eddy was ever as pleased to find his own premise in error as to prove that the opponent's position was untenable. Only ten days before his death he was planning to review the writer's work in stress-line analysis of problems of elasticity."

Truck Legislation in Oregon

One of the two definite considerations before the Oregon legislature which was called into special session Dec. 19 concerns the loading of motor vehicles. It is also possible that this special session will take some action on a $10,000,000 bond issue for state highway construction, the bonds to be paid for by a 1 cent additional tax on gasoline.

Railroad Commission Again Orders Los Angeles Union Station

Reaffirming its former conclusion that a union passenger station at the Plaza site is the fundamental solution of the grade crossing problem in Los Angeles, the California Railroad Commission on Dec. 9 directed the Southern Pacific, the Santa Fe and the Los Angeles and Salt Lake railroads to take immediate steps to obtain a site within the area defined as the plaza location in the former decision and to erect thereon a union terminal. This order came as the result of the rehearing concluded some weeks ago. The report of the original decision was published in *Engineering News-Record*, May 12, 1921, p. 829.

Although adhering to the original plan of using the plaza site as a joint depot for the roads named the decision after the rehearing has some modifications of the original order. The present order does not require the Pacific Electric Ry. to join with the steam lines in the use of the plaza site. Another modification is that the carriers themselves are now directed to submit plans and estimates instead of leaving this to a representative committee as in the original order. This modification was made after objection by the railroads. The three roads involved are required to file plans and estimates of cost of the proposed station within six months, together with a statement of the proportionate expense each is to bear. If the carriers are not able to agree on the division of cost the commission will fix the apportionment. After approval of the plans work must be started within ninety days and completed within three years, according to the decision.

Arkansas Local Improvement Bonds Sold at Premium

A $2,225,000 bond issue of a local improvement district which is constructing two bridges at Little Rock, Ark., across the Arkansas River, was sold recently to a St. Louis bond house at a premium of .0105 cents on the dollar. The price was considered by local bond dealers as remarkable in view of the conditions of the bond market. The bonds bear 6 per cent interest.

Water-Works School Planned for City Employees

A feature of the Dallas, Texas, Health Institute to be held at Baylor Medical College Jan. 16-21, under the direction of the State Director of Public Health, will be a water-works school for city employees. Various federal and state public health officials, as well as engineering educators are to lecture at the schools.

Florida Soon to Receive Bids on Roads Costing $2,500,000

Bids will be received by the Florida State Road Department on Jan. 4 and 5, for the construction of eight highway projects entailing the construction of 100 miles of highways and costing approximately $2,500,000. All roads will be 16 ft. wide with compacted rock base, surfaced with cement, concrete, asphalt, bituminous concrete or cement-grouted brick. Four of these projects will complete State Road No. 1 as far as Lake City from Jacksonville. The completion of the remaining two-thirds of the road awaits the sale of Escambia County bonds and the issuance of bonds by several intervening counties.

Large Water Main Laying Program at Oakland, Cal.

A two-year program for new water mains and replacements of old mains at Oakland, Cal., involving 48.8 miles of pipe at an estimated cost of about $1,000,000, has been announced by George H. Wilhelm, vice-president and general manager, East Bay Water Co. There will be some ten miles of 10- to 30-in. "sheet iron" pipe and the balance will be of 16 to 4-in. cast iron.

North Carolina Road Work Active

During October the North Carolina State Highway Commission awarded road contracts involving the construction of 138 miles of state highway to cost approximately $2,000,000. This was exclusive of the usual additional fees for engineering, contingencies, etc. On the 17 projects involved 274 bids were received. A little more than one-third of the mileage will be hard-surface in type, and, including usual clearing, draining, small reinforced concrete bridges, culverts and incidental work, the average cost per mile was $26,464. Pavement widths are 16 and 18 ft. The average price for the remaining mileage which included gravel, sand-clay or top-soil construction was $8,502 per mile, including the clearing, drainage structures, etc.

Investigates Delay in Sewage Disposal Plant Building

The Mayor of Dallas, Texas, has under taken an investigation of the long delay in the construction of a sewage disposal plant by Fort Worth. Interest of the Dallas Mayor in the project is explained by the fact that both cities are on the Trinity River and inasmuch as Fort Worth is above Dallas, the latter city gets a highly-polluted water. Bonds for the construction of the disposal plant were issued more than a year ago, but for undetermined reasons constduction has been delayed.

Chautauqua County Authorizes $1,000,000 Bond Issue

At the final session of the Chautauqua County, N. Y., supervisors held Dec. 9, approval of the issuance of $1,000,000 in road bonds was unanimously given.

Campaign Nets Million Dollars for California Stadium

A double-deck, reinforced-concrete and steel stadium to cost about $1,000,000 and to accommodate 60,000 people is proposed for the southwest corner of the campus at the University of California, Berkeley, Cal. In a recent campaign to raise funds for building the structure, $1,014,500 was secured by the sale of $100 script books which are good for a period of ten years, redeemable in tickets to any football game played by the California team.

Under the terms of an agreement between the athletic boards of California and Stanford universities, the annual football game between these two schools was to be played for two successive years in the stadium first completed. Stanford completed a stadium just in time for the game this year. The 1923 and 1924 games, it is expected, will be played in the proposed Berkley stadium.

Arkansas A. A. E. Organizes Advancement Society

Following the publication last year of articles dealing with the methods employed by local improvement districts in financing highway work, the Arkansas Chapter of the American Association of Engineer met recently to organize the Arkansas Advancement Society. The objects of the Society will be to combat untruths regarding the state and to spread truthful propaganda.

Investigation of the conditions has revealed the fact that not a penny of road-bond interest has been defaulted. Evidence of the activity of engineers in spreading the truth about the financial situation is seen by residents within the state in the result of a recent sale of bridge bonds by Pulaski county which brought $1.0105 in open competition.

Close Bidding for Main Piers of Philadelphia-Camden Bridge

Eleven bids for building the two main piers of the Philadelphia-Camden suspension bridge were received by the Delaware River Bridge Joint Commission on Dec. 19. Lump-sum bids were asked, based on sinking the Philadelphia caisson to El. —62 and the Camden caisson to El. —86, with some excavation below cutting edge and some rock left above cutting edge. The totals ranged from $1,669,275 to $2,553,000, the average being $2,138,279. The individual bids were:

Holbrook, Cabot & Rollins Corp., New York, and Keystone State Construction Co., Philadelphia, $1,669,275; Foundation Co., New York, $1,843,750; Eyre & Johnson, Philadelphia, $1,943,744; Arthur McMullen, New York, and Arundel Corp., Baltimore, $2,091,800; Vang Construction Co., Cumberland, $2,092,500; Booth & Flinn, Ltd., Pittsburgh, $2,151,750; H. P. Converse Co., Boston, $2,166,000; Dravo Contracting Co., Pittsburgh, $2,275,000; P. McGovern, Inc., New York, $2,285,500; Underpinning & Foundation Co., New York, $2,448,750; Fred'k Snare Corp., Phila., $2,553,000.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Convention, Cleveland, Ohio, Feb. 13-16.

AMERICAN ROAD BUILDERS ASSOCIATION, New York; Annual Convention and Good Roads Show, Chicago, Jan. 17-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 18-19.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Conference, Cleveland, Ohio, Jan. 17-19.

FEDERATED AMERICAN ENGINEERING SOCIETIES (American Engineering Council) Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 5 and 6.

The Engineering Society of Akron, Ohio, Mechanical Section, will have a joint meeting with the local section of the American Society of Mechanical Engineers on Dec. 30. An address on "Various Phases of Engineering Society Activity" will be made by Dexter S. Kimball, dean of Cornell University and president-elect of the American Society of Mechanical Engineers.

The National Highway Traffic Association held a public meeting in New York Dec. 12 to consider the unsatisfactory condition of the taxicab situation.

The Society of Municipal Engineers, Philadelphia Section, at its meeting Dec. 16, will be addressed by Messrs. Ralph Modjeski, George S. Webster and Laurence A. Bell on, "The Delaware River Bridge."

PERSONAL NOTES

C. L. ZULL, formerly assistant engineer on the Huffman dam, Miami Conservancy District, Dayton, Ohio, is now engineer for the Davis-Hunt Construction Co., Dayton.

L. M. SHUMAKER has been appointed resident engineer, Tennessee State Highway Department, at Erwin, Tenn.

WILLIAM T. PETERMAN, highway contractor, St. Landry, La., has been appointed chairman of the Louisiana State Highway Commission.

E. L. MILES has been appointed county engineer in addition to his regular duties as county road superintendent for the County of Victoria, Ont., with headquarters at Lindsay.

C. E. TILTON, town engineer of Phillipsburg, N. J., has resigned, to take effect Dec. 31.

RALPH A. BEEBEE has been appointed chief harbor engineer by the Oakland, Cal., City Council.

ROY N. TOWL, city commissioner, Omaha, Neb., for three years, has formed the civil engineering firm of Towl, Nelson & Schwartz, with offices in Omaha. During Mr. Towl's administration many large city planning projects were initiated and some of the

regrading projects were completed, Harry A. Nelson is a drainage engineer and Murray Schwartz city surveyor. The firm proposes to handle river bank protection, real estate development, paving, water and sewerage.

LEO HUDSON, who has been in consulting practice for the past fifteen years and JOHN P. MYRON, formerly with the Pittsburgh Filter Co., have formed a partnership under the name of Hudson & Myron, engineers, Pittsburgh.

THOMAS B. HUDSON, for the past five years superintendent of construction at the Baltimore plant of the Bethlehem Steel Co., is now with the Whiting-Turner Construction Co., Baltimore.

W. H. WILSON has resigned as secretary and general manager of the J. E. Moss Iron Works, Wheeling, W. Va., to engage in structural steel contracting, specializing in steel joist construction in Los Angeles, Cal., under the name of the Wilson Steel Co.

W. T. CHOLLAR, formerly with the advertising and sales promotion department of the Atlas Portland Cement Co. and the Lakewood Engineering Co., has joined the W. B. Conkey Co., Hammond, Ind., printers, publishers and bookbinders, as Eastern representative. He will be associated with E. W. Brenisen with headquarters in New York.

A. H. DUNLAP has assumed his duties as member of the Texas State Board of Water Engineers to fill the vacancy caused by the death of the late Judge W. T. Potter.

F. R. HODGDON of Joplin, Mo., has been appointed assistant engineer to S. Ashcraft, city engineer of Joplin. Credit H. S. Reifsnyder

WILLIAM C. WALKER, who has served the city of Altoona, Pa., for ten years, has resigned as construction engineer and superintendent of the bureau of highways, Altoona, to enter road-building work with headquarters at Hollidaysburg, Pa.

RALPH W. OREBAUGH has resigned as city manager of Westerville, Ohio, and will engage in the engineering and contracting business in Seattle, Wash.

COL. B. C. BALTYE, of London, England, representing the government of India, is in Canada in connection with the proposed establishment of a 100,000-hp. hydro-electric plant to supply Delhi and Lahore with light and power.

CHARLES O. BOYD, formerly district highway engineer of Raleigh County, W. Va., has resigned to become resident engineer with the Carolina Engineering Co. on street and sewer work for Wilmington, N. C.

BACKES & PFALLER, architects and engineers, have discontinued their Janesville, Wis., office and have opened an office in Milwaukee.

E. A. WINTHER, and Edward A. Juul, architects and engineers have opened offices in Sheboygan, Wis.

MAURICE L. MCKENNA has resigned as superintendent of construction for the City of Bridgeport, Conn. He held this position for four years and was formerly city engineer of Bridgeport.

EDWARD S. NETTLETON, acting city engineer of New Haven, Conn., since the resignation of Frederick L. Ford, has been appointed city engineer.

MAJOR G. E. HUMPHREY has resigned as manager of operations of the Federal barge line between St. Louis and New Orleans.

HENRY NEGSTAD has been appointed county highway superintendent of Brookings County, S. D.

J. GRESHAM, formerly engineer of Coldwell County, Tex., has been appointed engineer of Travis County, Tex.

A. A. EVERETT, assistant city engineer of Charleston, S. C., until a change occurred in the city administration in November, is now engaged on land survey and drainage work. His experience covers service with Taylor, Romine & Scott, civil and mining engineers; the City of McKeesport, Pa.; and the U. S. Steel Corp. His present address is Mt. Pleasant, S. C.

OBITUARY

HENRY T. EDDY, dean emeritus of the University of Minnesota, died at Minneapolis on Dec. 11 of pneumonia complicated by heart weakness. A fuller notice of his career appears on a preceding page.

JOHN J. NOLAN, vice-president, secretary and director of the Dravo Contracting Co., died recently in Pittsburgh, Pa. He was born in Carbondale, Pa., and was a graduate of Lehigh University.

BERNARD A. MILLER, Major, Engineer Corps U. S. Army, chief engineer of the American forces in Germany, died at Coblenz, Dec. 18.

BURTON J. ASHLEY, one of the oldtime civil engineers of Chicago, died at his home in that city Dec. 4, after a brief illness. He was born near Marengo, Ohio, in 1857, and was for some time county surveyor of Morrow County, Ohio. He moved to Chicago in 1888, where he practiced as a surveyor and later made a specialty of sanitary engineering, especially in regard to isolated sewerage and sewage disposal plants for large institutions in country districts. He was a member of the Western Society of Engineers.

BUSINESS NOTES

THE KOPPEL INDUSTRIAL CAR & EQUIPMENT CO., manufacturers of industrial cars, narrow-gage track materials, etc., with a plant at Koppel, Pa., and several branches throughout the country, has opened an office at Kansas City, Mo., with Harry C. Kraft as manager.

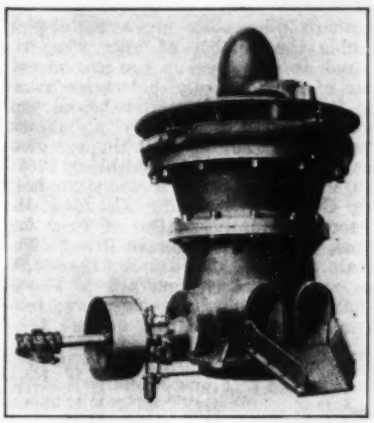
JOHN R. ALPINE has been appointed New York department manager of the Grinnell Co., representing the company's power piping, steam, hot water industrial piping interests.

The ASSOCIATED MACHINERY CORP. has been formed for the purpose of exporting construction equipment to India, Burma, and Ceylon. The following companies are incorporators: Pawling & Harnischfeger Co., Milwaukee; Novo Engine Co., Lansing, Mich.; Insley Manufacturing Co., Indianapolis, Ind.; Blaw-Knox Co., Pittsburgh, Pa.; and the Chain-Belt Co., Milwaukee. The managing director of the corporation has arrived in Burma where he will open offices and then proceed to India and Ceylon to open offices there. In addition to a full line of construction machinery, the corporation will handle a number of other products of American manufacture.

EQUIPMENT AND MATERIALS

Improved Gyratory Crusher

In a new gyratory crusher, built by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., the usual discharge opening is replaced by two openings separated by a vertical strut which forms a part of the shell casting. A larger opening and more free discharge are obtained, together with stronger construction. Three other openings are formed in the bottom shell, two of these



having light covers and the other having the countershaft bearing. This bearing may be placed on either side, for right hand or left hand drive as desired. A continuous ring on the spider surrounds the top of the shell and is split between the spider arms, so that by horizontal bolts at these joints the ring is clamped tightly against the shell. The contact faces of shell and ring are machined. The crushing shaft is shorter and of larger diameter than in other types of crushers built by this firm, and a steel bushing shrunk on the top journal enables the standard size to be restored without having to turn the bearing and use bushings in the spider. Another special feature is that oil is forced between the driving gear and the eccentric wearing ring, so that the gear and eccentric practically float on a film of oil. Lubrication is provided by a geared pump in a recess at the outer end of the countershaft bearing, but provision is made for dispensing with the pump and supplying oil from an overhead tank. Repairs and renewals of the principal working parts can be made without dismantling the entire machine.

Business Side of Construction

Facts and Events that Affect Cost and Volume

Engineering News-Record's Cost Index 1916 to Date

Engineering News-Record's Construction Cost Index Number is here tabulated monthly from January, 1916, to December, 1921, inclusive. The Index Number for the months of 1915 will be presented here next week.

ENGINEERING NEWS-RECORD
CONSTRUCTION COST INDEX
NUMBER
(100 in 1913)

	1916	1917	1918	1919	1920	1921
Jan.	130.46	167.75	184.51	198.05	206.55	230.87
Feb.	134.46	167.75	184.51	201.50	225.10	230.67
Mar.	142.96	175.66	184.51	198.05	240.85	224.27
Apr.	147.31	183.41	186.01	191.25	265.20	213.07
May	148.86	187.61	186.01	191.25	268.90	210.82
June	146.51	199.26	186.31	191.85	273.80	209.82
July	145.76	204.01	188.65	193.65	265.65	203.82
Aug.	146.56	198.41	193.85	196.65	252.00	193.07
Sep.	149.56	190.31	193.85	202.85	253.20	188.27
Oct.	152.91	167.11	193.85	202.25	255.20	182.57
Nov.	155.66	166.50	193.55	206.85	255.32	166.32
Dec.	167.15	167.11	194.75	206.85	251.62	167.82

Successful Bids on Pine Piles for Portland, Me.

The tabulation gives the bids accepted by the Directors of the Port of Portland, Me., on Nov. 28, for creosoted southern pine piles for a state pier. Double the number of piles were required as are given in the second column of the table, and bids were asked for the complete list (Bid A), as well as for half the quantity as shown. There were four bids on the complete list, the minimum total bid being $237,449. Contracts were awarded to both the Georgia Creosoting Co. and the Creosoting Materials Co. of New Orleans, whose unit bids are listed. The totals are $107,729.25 and $114,585.50, respectively. Fay, Spofford & Thorndike are the consulting engineers; John Ayer, engineer in charge.

Length in Feet	Number of Piles	Price per Pile	
50 to 54	125	$25.07	$29.12
55 to 59	150	27.75	31.92
60 to 64	150	30.97	34.72
65 to 69	325	33.39	37.52
70 to 74	175	36.70	40.32
75 to 79	250	40.56	43.12
80 to 84	350	43.87	45.92
85 to 89	1,125	47.05	48.72
Additional Creosote Oil, 250 gal.		0.35	0.15

Food and Wages

Retail prices are 49 per cent above the 1913 level, against 50 per cent in October, according to the Bureau of Labor statistics. The decline since November, 1920, is 28 per cent.

Payrolls of 118 steel-making establishments listed 124,147 men, $5,274,084, in November, 1921, against 185,547 men, $14,720,283, in the same month of 1920. The decrease in numbers is 33 per cent, in pay 64 per cent. There is a slight improvement over October, 1921.

The Associated Contractors of Massachusetts, by formal vote at Worcester, on Dec. 14, declared that wages in the building industry must be lower in 1922. They voted also not to permit unions connected with the industry to dictate working conditions and not to sign any written agreement with the unions.

Six Salient Features of New Federal Tax Bill

Excess Profits Tax Repealed—Surtax on Individual Incomes Reduced—Advantages of Incorporation

Among the numerous changes made by the new tax bill signed by President Harding on November 23d, six stand out as of great importance from the point of view of the business man and the investor. These are:

(1) The abolition of the Excess Profits Tax, from Jan. 1, 1922, coupled with an increase in the income tax on corporations at that time from 10 per cent to 12½; (2) reduction in the surtax rates on individual incomes; (3) establishment of a new class of income to be known as capital gain, which will be subject to a maximum rate of 12½ per cent; (4) broadening of the definition of "closed transaction," effective for the current year, which makes possible many exchanges of property without subjecting the gain to taxation; (5) recognition, beginning this year, of a net loss from one year's operation as an offset against any profits which may accrue in the two following years; (6) inducements offered to persons conducting business as individuals or partnerships to incorporate, thereby obtaining advantage of a lower total rate on corporate income.

Excess Profits Tax Repeal.—In spite of great pressure, Congress finally declined to repeal the profits tax for 1921 but did agree to abolish it thereafter. With it disappears the "personal service corporation," a special class established to care for certain corporations which it was desired to exempt from profits taxation. When the profits tax goes, the income tax rate on all net income of corporations rises from 10 to 12½ per cent. The change in the rate will cause corporations which make only moderate profits to pay slightly heavier taxes but the total tax burden on corporate income will be much lighter, the official estimates of revenue under the new bill calling for $1,030,000,000 from this source (ignoring back taxes) this fiscal year and only $695,000,000 for the next fiscal year, when the change will be in force.

The surtax rates on individual incomes are scheduled for reduction beginning with the first of next year.

The most revolutionary section in the new act is Section 206 which sets up a new division of income. After the first of next year money made by individuals by selling or exchanging property "held for profit or investment" is subject to a maximum rate of 12½ per cent, instead of the regular rates which range as high as 58 per cent (normal plus surtaxes). This is hedged about by several restrictions. The individual may not take advantage of the permission to use the 12½ per cent rate unless he is willing to pay at least 12½ per cent on his other income as well. The property "held for profit or investment" must have been so held for more than two years and may not include property "held for the personal use or consumption of the taxpayer or his family," or property which properly is subject to inventory. It is not necessary, however, that the property be connected with his trade or business.

The "Closed Transaction."—The advantage to the investor in property which is gaining in value, conferred by the section just described, is accentuated by the liberal provisions governing the "*closed transaction.*" This has long been a troublesome section of the field on income tax procedure. When one exchanges property for cash, no question arises. The transaction is "closed" and one accounts for his gain to the tax collector. But when one barters instead of sells, receiving other property instead of cash for this property, very serious questions arise. There are sometimes differences of opinion as to the value of the property received which lead to disputes and litigation. The old law went so far as to say that, in the case of such trades, the property received was to be treated as cash "to the amount of its fair market value, if any" (with certain exceptions in the case of such corporate reorganization, 1918 Law, Section 202). The new law goes much further. It now states positively that no gain or loss on trades shall be recognized unless the property received on the trade "has a readily realizable market value." The phrase, "*readily realizable,*" adds a new and liberalizing element.

Net Losses.—With one minor exception included in the 1918 law, it has been the practice since the beginning of income taxation in this country to treat each year as a unit and to refuse to permit the fact that one has lost money this year to affect the amount of profits he must report the following year. Each accounting period has been carefully "insulated" from other accounting periods. This practice has worked much hardship and the new law breaks away from the old precedents by inserting a provision, effective for 1921 (Section 204, with a restriction on mines), which permits a net loss suffered in one year to be offset against any net income in the next two succeeding years. In other words, losses may be used to blot off subsequent gains but losses are "outlawed" for this purpose after the expiration of two years.

Corporate Tax Advantages.—According to Section 229 an individual or a partnership engaged in trade or business, is given the option of being taxed for the year 1921 either as a corporation or as individuals, under the following conditions: (1) Capital must constitute an important income producing factor in the business; (2) the capital stock tax for 1921 must be paid by the taxpayer who is assessed on a corporate basis; (3) the business must be incorporated within four months after the passage of the act, which was signed by the President on Nov. 23; (4) the taxable income for the year 1921 must be equal to or more than 20 per cent of the invested capital.

Lumber Mills Replenishing Stocks on Hand

An earnest effort on the part of the larger lumber producers of the country to increase their supply of stock on hand, is the outstanding trend of recent lumber activities according to A. Fletcher Marsh, chairman of the statistical committee of the American Wholesale Lumber Association. A compilation of figures for all associations shows that the lumber manufacturers are attempting to keep up lumber production at the mills in spite of the seasonal tendency at this time of the year for orders to fall off. A comparison between lumber production and the shipments of all revenue tonnage on the part of the railroads shows that although railroad loadings of all commodities are falling off sharply, the lumbermen are nevertheless attempting to keep up their production to replace the large volume of lumber shipped during the earlier fall months. For the week ending Dec. 3 production was 18 per cent larger than orders, and shipments covered by previous orders amounted to 20 per cent of new business, meaning that shipments for all reporting associations are ahead of production and orders.

In the largest producing fields the southern pine district and northwest Pacific coast, production is ahead of new business and shipments. It was in the woods from these districts that the heavy fall demand was felt for new building activity in house construction and railroad material. Southern pine orders were 72 per cent of production while on the northwest coast they were 77 per cent. Apparently little effort will be made on the part of sawmill operators to solicit new business until the turn of the year.

For the second week of December the volume of new business from the South and from the north Pacific coast is very close together, there being now a difference of only 5,000,000 ft. With new rate reductions from the north Pacific coast, effective Dec. 24, this difference in volume may become even less.

From compilation of the West Coast Association, where fir, hemlock, cedar and spruce are the four important woods, business for the week ending Dec. 10 showed 57 per cent for rail shipment, 31 per cent for domestic cargo shipment and 12 per cent for export, while the unshipped balance, showed orders on hand covering three weeks' business in rail shipment, five weeks in the domestic cargo trade and ten weeks in the export trade, giving a firm undertone to the export trade which has for some months been supporting the Coast business to a considerable extent.

Bids Wanted on Big Jobs

Among the projects on which bids are either being asked or will soon be called for in Construction News, pp. 271@278, are the following:

Ore dock for the Great Northern Ry. at Superior, Wis., $2,000,000.

Hospital for the University of Wisconsin at Madison, $1,200,000.

Apartment Hotel at Chicago, $3,000,000.

Next Week—Paving Prices; Materials and Recent Contracts

Chicago Practically Open Shop for Carpenter Trade

The carpenters' union in Chicago, which has refused to accept the Landis award, attempted unsuccessfully Dec. 15 to obtain a temporary injunction restraining the banking interests from refusing to loan money except to builders who would carry out work under the Landis award. Another hearing was set for Dec. 21. A counter answer will be set up that the union is monopolistic.

The Citizens' Committee to Enforce the Landis Award holds almost daily meetings and was assured Dec. 9 by its executive committee that the fight for an open shop for carpenters had been attained beyond all reasonable doubt. Further, they asserted that it would probably soon be necessary to "open up" several other trades. Dec. 12 a delegation of lighting-fixture contractors served notice that neither they nor the union would accept the award conditions. A negative vote on the same question has been taken in the plumbers' union, which insists on retaining "monopolistic and wasteful" methods. Two unions, marble setters and machinery movers, have agreed to eliminate "wasteful" agreements and at a rehearing Dec. 8, Judge Landis increased their pay from 92½ to 97½c. per hour. Eight other unions refused to remove artificial restraints and were denied a rehearing by him.

Trend of Business

Bonds—Rise continues for municipals, the bid for the $55,000,000 New York 4½s is said to be the highest since 1909 for this class of bond. Buffalo serial 4½s, offered Dec. 16, to yield 4.05 were quickly sold. The week's activity was principally in the municipals and foreign issues, industrials and public utilities running behind. On Dec. 19 the National City Co. bought $25,000,000 consolidated 4s of the Canadian Pacific Railway Co., and $30,000,000 Danish bonds. This is said to be the first premier security of the Canadian Pacific Railway Co. to be sold in the United States, London having taken all previous issues.

Stock Market—Interest centers chiefly in prospects for 1922.

Foreign Exchange — Sterling touched $4.24¼, highest since October, 1919. On Dec. 19 new high levels for the year were established in Denmark, Sweden, Holland and Switzerland rates, with sterling at $4.215, and the German mark at .56 cents.

Money—Market stiffened moderately owing to certain government operations. Call money advanced to 5½ per cent, with time rates unchanged. It is anticipated that money will be easier after Jan. 1.

Steel—Unfilled orders on the Steel Corporation books on Nov. 30 were only 4,250,542 tons, the smallest in six years. The Corporation operated at 52 per cent capacity.

Auction of 1898 houses and business buildings constituting Yorkship and Morgan Villages, Camden, N. J., owned by the U. S. Shipping Board, brought $4,594,445.

Price-Trading Plan of Hardwood Men Declared Illegal

In a decision made public Dec. 19, the U. S. Supreme Court declared the "open competition" plan of the American Hardwood Manufacturers Association a restraint upon trade in violation of the Sherman anti-trust law. The association, consisting of 603 individuals and corporations, was charged, in the suit brought by the government, with enhancement of prices through exchange of bulletins and reports on stocks, prices and production. The vote was six to three on the decision, Justices Brandeis, Holmes and McKenna dissenting.

Terra Cotta Men Fined

Fines of $3,000 each were imposed recently upon seven corporations and ten individuals engaged in New York in the manufacture and distribution of architectural terra cotta who pleaded guilty to an indictment drawn under the Sherman anti-trust law. The indictments resulted from evidence brought to light by the investigations being carried on by the Lockwood joint legislative committee on housing into building conditions in New York City.

Charge Tile Men Still Active

Though punishment has been inflicted upon employers and union officials in the building trades the charge was made recently in testimony brought out by the Lockwood joint legislative committee on housing, investigating building conditions in New York City, that employers continue to meet regularly and "rig" bids, and unions persist in reinstating members who have served terms in jail. The testimony was brought out by Hyman L. Morse, a Brooklyn builder, who told the committee that about three weeks ago, a week after a group of tile contractors had been fined, four of them being sent to jail, he was informed by a tile contractor in Brooklyn that tile men were again holding their meetings. Testimony was also brought out to the effect that two union members of Plumbers Local 463, who had served terms in the penitentiary for coercion as a result of the Lockwood committee's inquiry, had been reinstated when they came out of jail.

Distribution of Texas Pavements

Paved streets in Texas totaled only 706.171 miles or 15,281,174 sq.yd. at the beginning of 1921, according to L. W. Kemp, of The Texas Co. These were distributed among fourteen kinds of pavement, as follows:

Kind	Square Yards	Miles
Warrenite-Bithulithic	4,828,617.79	214.285
Vitrified brick	2,788,825.08	115.390
Asphaltic concrete	1,760,137.95	97.853
Uvalde rock asphalt	1,234,202.81	63.138
Creosoted wood blocks	1,127,808.83	46.091
Asphalt macadam	975,090.82	49.068
Concrete	959,763.41	47.387
Sheet asphalt	560,598.32	23.731
Oklahoma rock asphalt	525,912.06	25.586
Vibrolithic	223,207.69	11.501
Granitoid	180,208.81	8.744
Hassam	55,355.12	1.537
Willite	36,726.67	1.100
Westurmite	24,718.43	0.820

The Texas Highway Commission now has under construction approximately 2,500 miles for which more than $30,000,000 is available.

Railroad Wage Meeting Set for January 16

The 52 railroads comprising the classification territory north of the Ohio and east of the Mississippi River have sent notices to their employees designating January 16 as the date on which conferences will start for the negotiation of wage adjustments. Decreases in pay ranging from 10 to 20 per cent have been asked by the railroads for train service and other classes of workers, while the shop craft and maintenance-of-way men have countered with demands for an increase in pay.

Interstate Commerce Commission Agrees to Cut in Freight

The Interstate Commerce Commission has accepted the voluntary proposal of the railroads for the inauguration of a decrease in freight rates on practically all farm, range and orchard products in the United States outside of New England. The decrease approximates 10 per cent.

Railroad Buying Continues

Among important transactions recently in railroad equipment were contracts placed by the New York Central for 125,000 tons of rails with an option of 25,000 tons additional and inquiries by the Union Pacific for 70 cars for passenger train service. The Pere Marquette announced the placing of orders with the Western Steel Car & Foundry Co. for 500 box cars with an option for 500 additional. Other contracts cover 800 steel and composite cars.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted. Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section. The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of December 1; the next, on January 5.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$2.78	$4.00	$4.00	$2.88	$3.06	$3.75	$3.45	$3.75	$4.00
Structural rivets, 100 lb.	3.50	5.25	5.50	3.43	4.15	4.25	5.50	4.25	6.50
Reinforcing bars, ¾ in. and larger, 100 lb.	2.68	3.20	3.50	2.68	3.08½	3.57½	3.00	3.75	2.75
Steel pipe, black, 2½ to 6 in. lap, discount	—61%	57.65%	45%	57%	—61.9-5%	-41%	—53.7%	50%	35.10
Cast-iron pipe, 6in. and over, ton	47.30@48.30	45.00	54.30	44.10	47.80	52.00	50.00	55.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.30	2.69	2.55	1.97	2.26	3.10	2.84	3.10	—3.12
Gravel, ¾ in., cu.yd.	1.75	1.85	2.25	2.00	1.50	2.50	2.25	1.50	1.50
Sand, cu.yd.	1.00	1.25	2.25	2.00	.50	1.10	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.80 to 1.90	2.00	3.20	1.60	2.25	3.50	2.25	3.00	2.10
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	49.00	38.00	34.00	48.00	35.00	50.00	30.00	—22.00	120.00
Lime, finishing, hydrated, ton.	16.99	19.00	25.00	18.00	29.00	30.00	22.00	27.00	21.00
Lime common, lump, per bbl.	3.39@3.69	1.50	2.75	1.40	1.40	2.95	1.90	3.25	11.00
Common brick, delivered, 1,000.	17.40@18.40	9.00	12.72	11.00	17.00	14.00	15.50	14.00	16.00
Hollow building tile, 4x12x12, block	Not used	.0675	.13	.0821	.0792	.09	.12½	.10	.08@.29
Hollow partition tile 4x12x12, block	.11120	.0675	.13	.0657	....	.10	.14½	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.72	—.78	.88	.74	.80	.90	.83	.79	.85
Common Labor:									
Common labor, union, hour.	.75	.35	.....	.72½	.50	.50@.55	.75	.50@.60	..
Common labor, non-union, hour.	.....	.20	.35@.45	.35@.40	.50	.35@.40	.50@.55	.50	.25@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent, 45@50 means a range of 45 to 50 per cent. Charge of 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over. **New York** quotations are delivered except tiles, which are "on trucks." Common lump lime per 280-lb. net; both lump and hydrated quoted f.o.b. cars New York. Sand gravel and crushed stone are quoted alongside dock. Cement and steel pipe delivered to contractors on job. Gravel ready mixed $2 per cu.yd. **Chicago** quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. **Minneapolis** quotes on fir instead of pine. Brick and hollow tile delivered. Cement on cars; $2.45 delivered. Gravel, sand and crushed stone quote at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.55 for Sheboygan. Common labor not organized. **Denver** quotes cement "on tracks"; gravel and sand at pit, stone on cars, lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered. Common lump lime per 180-lb. net. **Atlanta** quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net. **Dallas** quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered. **San Francisco** quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to contractors in yards at San Francisco. **Seattle** quotes on Douglas fir instead of pine. Lump finishing lime per 180-lb. net. **Montreal** quotes sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone, on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile, per ft. Cement price is in Canadian funds (the Canadian dollar stands at 91.2 cents). Bag change is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net.

Changes Since Last Week

Increased discounts on wrought steel pipe, all sizes, are quoted on the new Pittsburgh basing card of Dec. 15, averaging 3 per cent on black and 2½ per cent on galvanized. This is a reduction of about $5 per ton and constitutes the first change on the basing card since Sept. 16. The mill change has been immediately reflected in warehouse quotations. New York quotes 2½ to 6 in., lap-weld, black steel pipe at 61 per cent as against 54 per cent from list; Denver quotes 41 per cent instead of 38 per cent and San Francisco 53.7 per cent as compared with 51.8 per cent.

Structural steel shapes continue at $1.50, Pittsburgh, in lots of 100 tons or more; smaller tonnages at $1.60 per 100 lb. Keen competition has resulted in quotations, at the mill, as low as $1.45 per 100 lb. on reinforcing bars.

With increasing lumber demand, particularly for export, an impending log shortage is reported in Seattle. Lumber mills and logging camps at this point are resuming operations on a large scale, many of them foregoing the annual holiday shut down.

According to the National Lumber Manufacturers' Association production at 373 mills, for the week ending Dec. 10, at 176,554,176 ft., shipments at 155,405,188 ft., and orders for 146,953,064 ft. These figures show an increase in production of 16,248,444 ft. over the preceding week; a decrease of 9,957,330 ft. in shipments and an increase in orders of 13,861,007 ft. Total lumber production for the month of November, reported by seven members of the Association, show 705,714,521 ft. cut; shipments amounting to 729,290,377 ft. and orders covering 693,102,927 ft.

Lumber production stands at nearly 25 per cent; orders over 37 per cent and shipments at 35 per cent below normal. The lumber situation is further discussed on p. 1043 of this section.